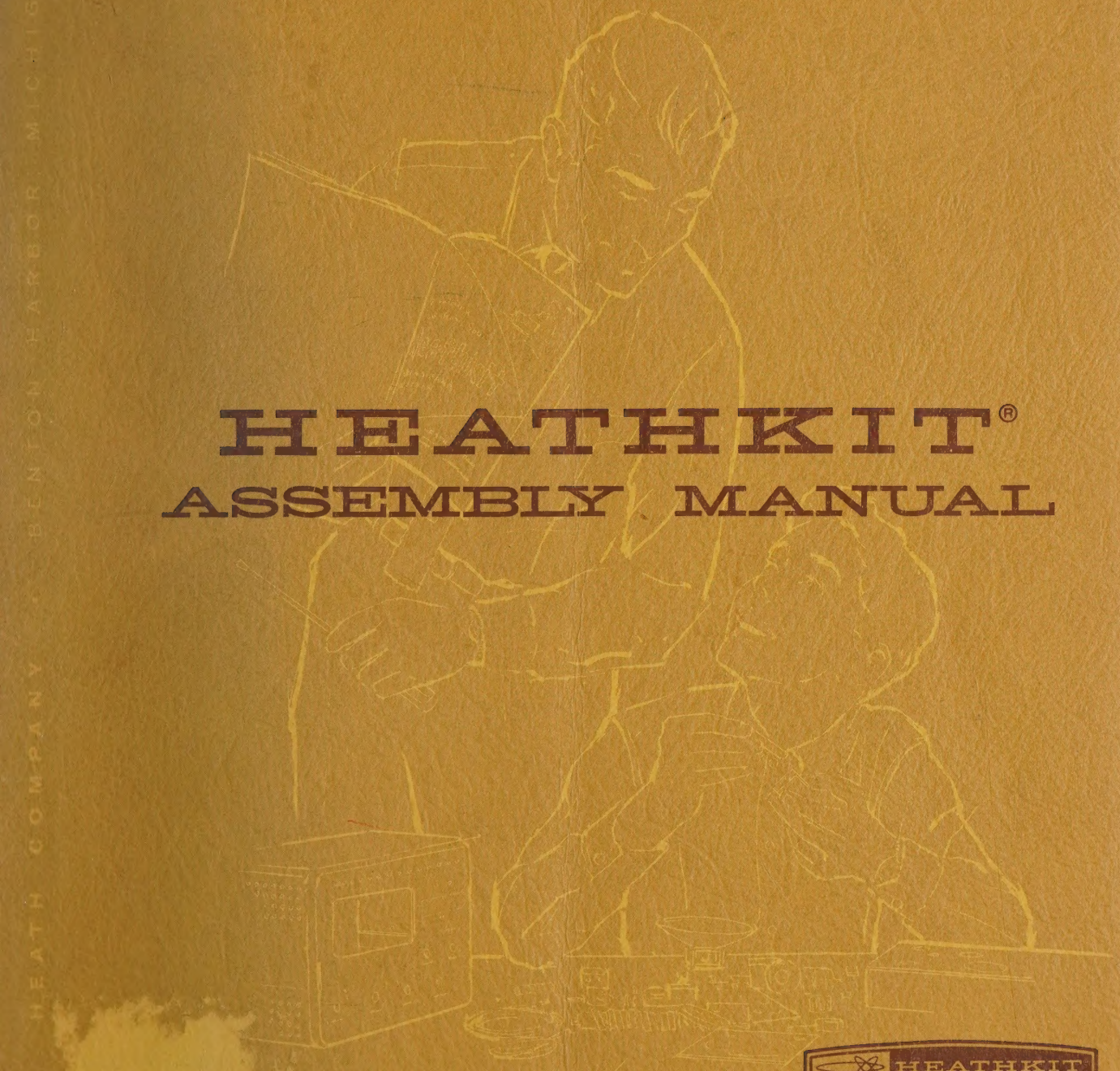
PRICE $2.00

HEATH COMPANY, BENTON HARBOR, MICHIGAN



HEATHKIT®
ASSEMBLY MANUAL

HEATHKIT

TV POST MARKER GENERATOR

MODEL IG-14

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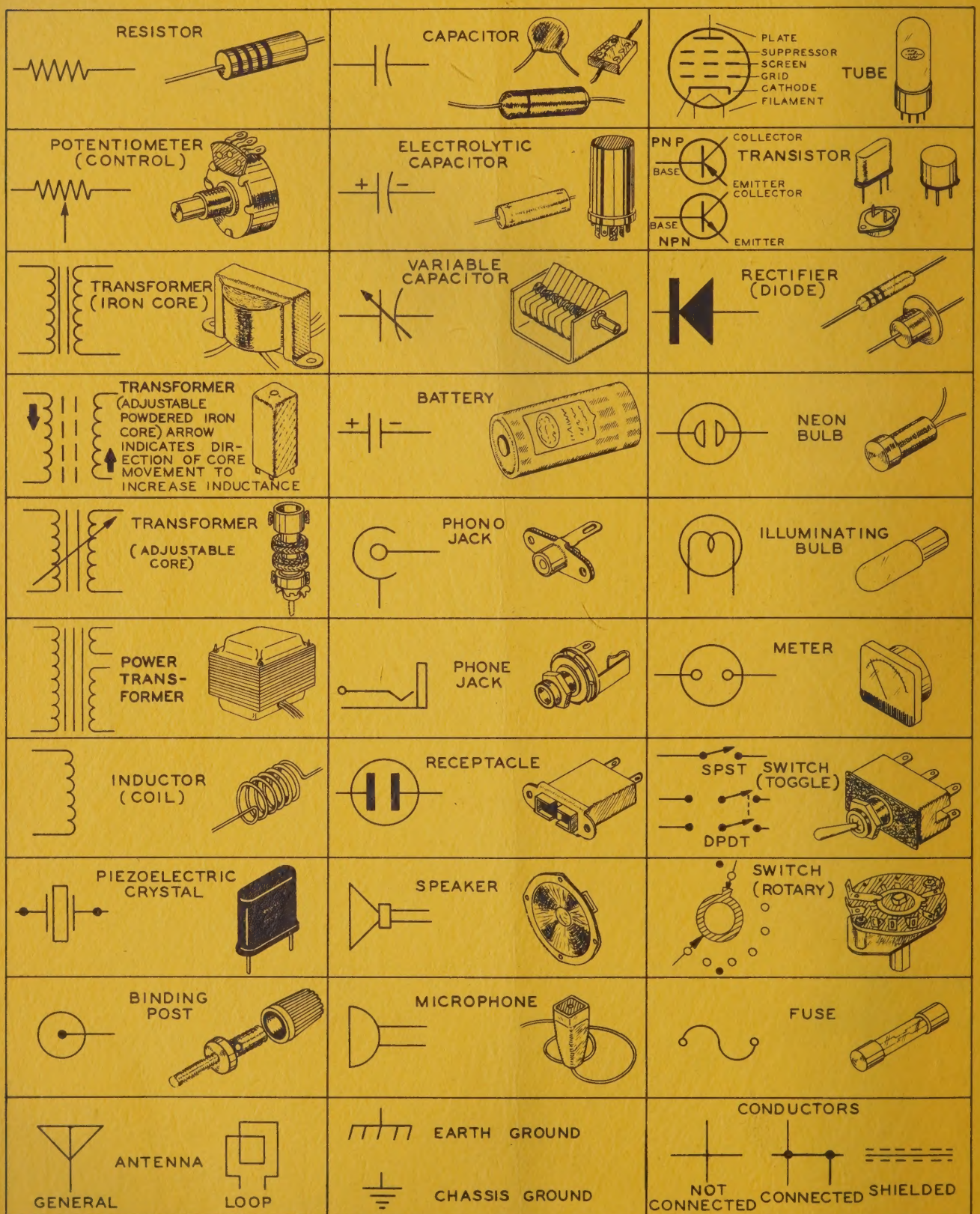
TYPICAL COMPONENT TYPES

This chart is a guide to commonly used types of electronic components. The symbols and related illustrations should prove helpful in identifying most parts and reading the schematic diagrams.

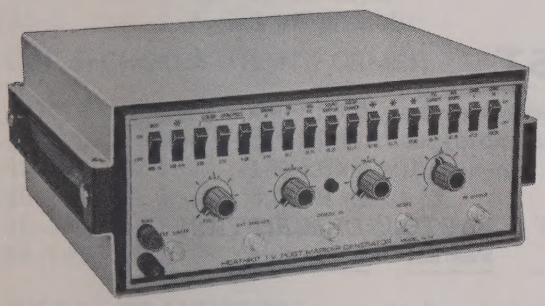


Assembly
and
Operation
of the

HEATHKIT

TV POST MARKER GENERATOR

MODEL IG-14



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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

1-19-68

INTRODUCTION

The Heathkit Model IG-14 TV Post Marker Generator produces accurate markers at the IF and RF frequencies specified by most television manufacturers.

The Post Marker Generator mixes the marker signal with the demodulated signal from the circuit being tested or aligned. The markers are sharp and well defined and will not alter or distort the response curve of the circuits involved. Therefore, the oscilloscope will show the actual waveshape of the device.

As many as six markers may be made to appear simultaneously on an IF trace. This enables you to adjust the IF circuits for proper waveshape and bandwidth in much less time than would be possible if you were to use the old variable marker system which must be reset and calibrated for each marker frequency.

Additional markers are provided for color bandpass alignment; picture and sound carrier frequencies for channels 4 and 10; FM tuner, FM IF, and discriminator alignment; and television sound IF adjustments. Modulation at 400 Hz is provided for trap adjustment and for checking and adjusting FM tuners. Also provided is a variable bias supply, which may be used as a source of positive or negative voltage.

All of these features combine to provide you with a versatile, accurate, and attractive test instrument that is designed for long and dependable service at minimum cost.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

The numbers in parentheses are keyed to the numbers on the Parts Pictorial (fold-out from Page 5).

PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS		
1/2 Watt		
(1) 1-146	2 ✓	75 Ω (violet-green-black)
1-3	22 ✓	100 Ω (brown-black-brown)
1-66	1 ✓	150 Ω (brown-green-brown)
1-45	15 ✓	220 Ω (red-red-brown)
1-7	1 ✓	680 Ω (blue-gray-brown)
1-9	6 ✓	1000 Ω (brown-black-red)
1-11	5 ✓	1500 Ω (brown-green-red)
1-13	2 ✓	2700 Ω (red-violet-red)
1-16	9 ✓	4700 Ω (yellow-violet-red)
1-19	1 ✓	6800 Ω (blue-gray-red)
1-73	6 ✓	8200 Ω (gray-red-red)
1-20	4 ✓	10 kΩ (brown-black-orange)
1-109	1 ✓	12 kΩ (brown-red-orange)
1-21	1 ✓	15 kΩ (brown-green-orange)
1-22	1 ✓	22 kΩ (red-red-orange)
1-23	1 ✓	27 kΩ (red-violet-orange)
1-25	5 ✓	47 kΩ (yellow-violet-orange)
1-47	9 ✓	56 kΩ (green-blue-orange)
1/2 Watt (cont'd.)		
1-60	1 ✓	68 kΩ (blue-gray-orange)
1-26	1 ✓	100 kΩ (brown-black-yellow)
1-121	1 ✓	120 kΩ (brown-red-yellow)
1-31	1 ✓	330 kΩ (orange-orange-yellow)
1-32	1 ✓	390 kΩ (orange-white-yellow)
1-37	1 ✓	2.2 MΩ (red-red-green)
(2) **1 Watt**		
1-17-1	2 ✓	100 Ω (brown-black-brown)
CAPACITORS		
Disc		
(3) 21-78	1	5 pF
21-3	9	10 pF
21-60	4 ✓	18 pF
21-5	1	20 pF

PART No.	PARTS Each	DESCRIPTION
Disc Capacitors (cont'd.)		
21-84	6	24 pF
21-7	6	33 pF
21-32	1	47 pF
21-85	1	56 pF
21-96	3	85 pF
21-9	5	100 pF
21-13	1	500 pF
21-14	12	.001pF
21-26	2	.003 μF
21-72	4	.005 μF, 1400 V (1.4 kV)
21-47	15	.01 μF
Electrolytic		
(4) 25-149	2	5 μF, 15 V
(5) 25-194	2	100 μF, 25 V
25-193	2	250 μF, 35 V
Other Capacitors		
(6) 25-200	1	.68 μF 35 V Tantalum
(7) 27-46	3	.047 μF Mylar*
27-47	3	.1 μF Mylar
(8) 28-2	1	1 pF phenolic
COILS-CHOKES-TRANSFORMER		
(9) 40-478	2	Oscillator coil (brown)
(10) 40-479	8	Oscillator coil (red)
(11) 40-820	1	100 kHz oscillator coil
(12) 45-6	2	8.2 μH choke
(13) 45-39	1	4.7 μH choke
54-191	1	Power transformer
DIODES-TRANSISTORS		
(14) 57-27	3	Silicon diode
(15) 56-32	1	13.6 volt zener diode
(16) 417-118	6	2N3393 transistor
(17) 417-108	16	2N3692 transistor
CRYSTALS		
(18) 404-332	1	3.080 MHz
404-333	1	4.080 MHz
404-4	1	4.5 MHz (4500 kHz)
404-39	1	10.7 MHz
(19) 404-238	1	3.579 MHz (3579.545 kHz)
(20) 404-334	1	39.750 MHz
404-335	1	41.250 MHz
404-336	1	42.170 MHz
404-337	1	42.500 MHz

PART No.	PARTS Per Kit	DESCRIPTION
Crystals (cont'd.)		
404-344	1	42.750 MHz
404-338	1	45.000 MHz
404-339	1	45.750 MHz
404-340	1	47.250 MHz
404-341	1	67.250 MHz
404-342	1	96.625 MHz
CONTROLS-SWITCHES		
(21) 19-116	1	10 kΩ control with push-pull switch (Bias)
(22) 10-225	1	100 Ω control (RF)
10-223	1	10 kΩ control (Marker)
10-224	1	1 MΩ control (Trace)
(23) 60-32	17	DPDT rocker switch
SOCKETS-CONNECTOR-PLUGS-STRIPS		
(24) 434-107	1	Phono socket
(25) 432-4	1	AC connector
(26) 432-58	4	Coaxial plug
(27) 438-4	1	Phono plug
(28) 432-59	5	Coaxial connector
(29) 431-3	1	3-lug terminal strip
(30) 431-11	1	5-lug terminal strip
CABLE-WIRE		
89-3	1	Line cord with plug
343-7	1	Small coaxial cable
343-9	4	Large coaxial cable
341-1	1	Black test lead
341-2	1	Red test lead
344-50	1	Black wire
344-52	1	Red wire
344-54	1	Yellow wire
344-56	1	Blue wire
344-59	1	White wire
HARDWARE		
#4 Hardware		
(31) 250-34	1	4-40 x 1/2" screw
(32) 250-52	52	4-40 x 1/4" screw
(33) 252-2	1	4-40 nut, large
(34) 252-15	17	4-40 nut, small
(35) 254-9	17	#4 lockwasher

*DuPont Registered Trademark

PART No.	PARTS Per Kit	DESCRIPTION
#6 Hardware		
(36) 250-56	22	6-32 x 1/4" screw
(37) 250-162	4	6-32 x 1/2" screw
(38) 250-229	8	6-32 x 1/4" phillips screw
(39) 252-3	22	6-32 nut
(40) 254-1	18	#6 lockwasher
(41) 259-1	5	#6 solder lug
(42) 250-303	4	6-32 x 1/4" decorative head screw
(43) 250-304	4	6-32 x 7/16" spacer stud
Other Hardware		
(44) 252-7	4	Control nut
(45) 254-4	3	Control lockwasher
(46) 259-10	4	Control solder lug
(47) 253-10	4	Control flat washer
(48) 252-9	1	Speednut
(49) 427-3	2	Binding post base
(50) 455-50	4	Knob bushing
METAL PARTS		
(51) 200-503	1	Chassis
(52) 203-503	1	Front panel
(53) 203-504	1	Rear panel
(54) 90-374	2	Cabinet half-shell
Metal Parts (cont'd.)		
(55) 204-812	2	Siderail
(56) 204-759-1	4	End cap
(57) 204-811	1	Switch bracket
(58) 210-35	1	Bezel
MISCELLANEOUS		
85-192-1	1	Amplifier circuit board
85-193-1	1	Oscillator circuit board
(59) 75-17	4	Insulator bushing
(60) 100-16-2	1	Black binding post cap
100-16-18	1	Red binding post cap
(61) 413-10	1	Red lens
(62) 412-15	1	Neon lamp
(63) 462-248	4	Knob
(64) 261-28	4	Plastic foot
(65) 260-16	8	Alligator clip
(66) 75-15	1	Terminal shell (drilled)
(67) 75-16	1	Terminal shell (plain)
(68) 211-34	2	Handle
(69) 391-34	1	Blue and white label
(70) 490-1	1	Plastic alignment tool
(71) 490-5	1	Nut starter
346-2	1	Clear sleeving
331-6		Solder
597-260	1	Parts Order Form
597-308	1	Kit Builders Guide
595-915	1	Manual

STEP-BY-STEP ASSEMBLY

Before starting to assemble this kit, read the Kit Builders Guide for complete information on wiring, soldering, and step-by-step assembly procedures.

CIRCUIT BOARD ASSEMBLY

Before starting to assemble the circuit board, be sure you have read the wiring, soldering, and step-by-step assembly information in the Kit Builders Guide.

Position all parts as shown in the Pictorials. Follow the instructions carefully, and read the entire step before performing the operation. Use 1/2 watt resistors unless directed otherwise in a step. All resistors will be called out by the resistance value (in Ω, kΩ, or MΩ) and the color code. Capacitors will be called out by the capacitance value and type.

Perform each step in the order listed and complete each Pictorial before proceeding to the next Pictorial. When the circuit board is finished, set it aside until it is called for later on in the assembly instructions.

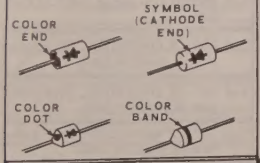
START

( ) Position the amplifier circuit board (#85-192-1) lettered side up as shown in the following Pictorials.

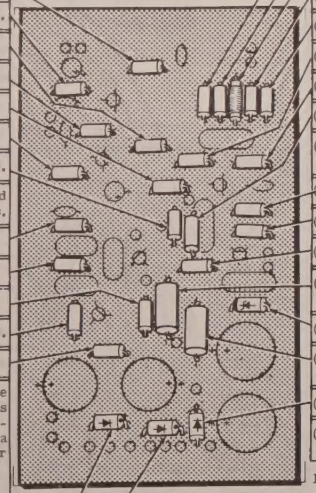
NOTE: Do not solder the leads until directed to do so in a step.

(✓) 2.2 MΩ (red-red-green).
(✓) 390 kΩ (orange-white-yellow).
(✓) 1000 Ω (brown-black-red).
(✓) 10 kΩ (brown-black-orange).
(✓) 12 kΩ (brown-red-orange).
(✓) 100 Ω (brown-black-brown).
(✓) 100 kΩ (brown-black-yellow).
(✓) Solder all leads to the foil and cut off the excess lead lengths.
(✓) 2700 Ω (red-violet-red).
(✓) 2700 Ω (red-violet-red).
(✓) 680 Ω (blue-gray-brown).
(✓) 330 kΩ (orange-orange-yellow).
(✓) 100 Ω (brown-black-brown).

NOTE: When installing diodes, the cathode end must be positioned as shown on the circuit board. The cathode end is marked with either a color end, color dot, color band, or a symbol.



(✓) Silicon diode (#57-27).
(✓) Silicon diode (#57-27).
(✓) Solder all leads to the foil and cut off the excess lead lengths.



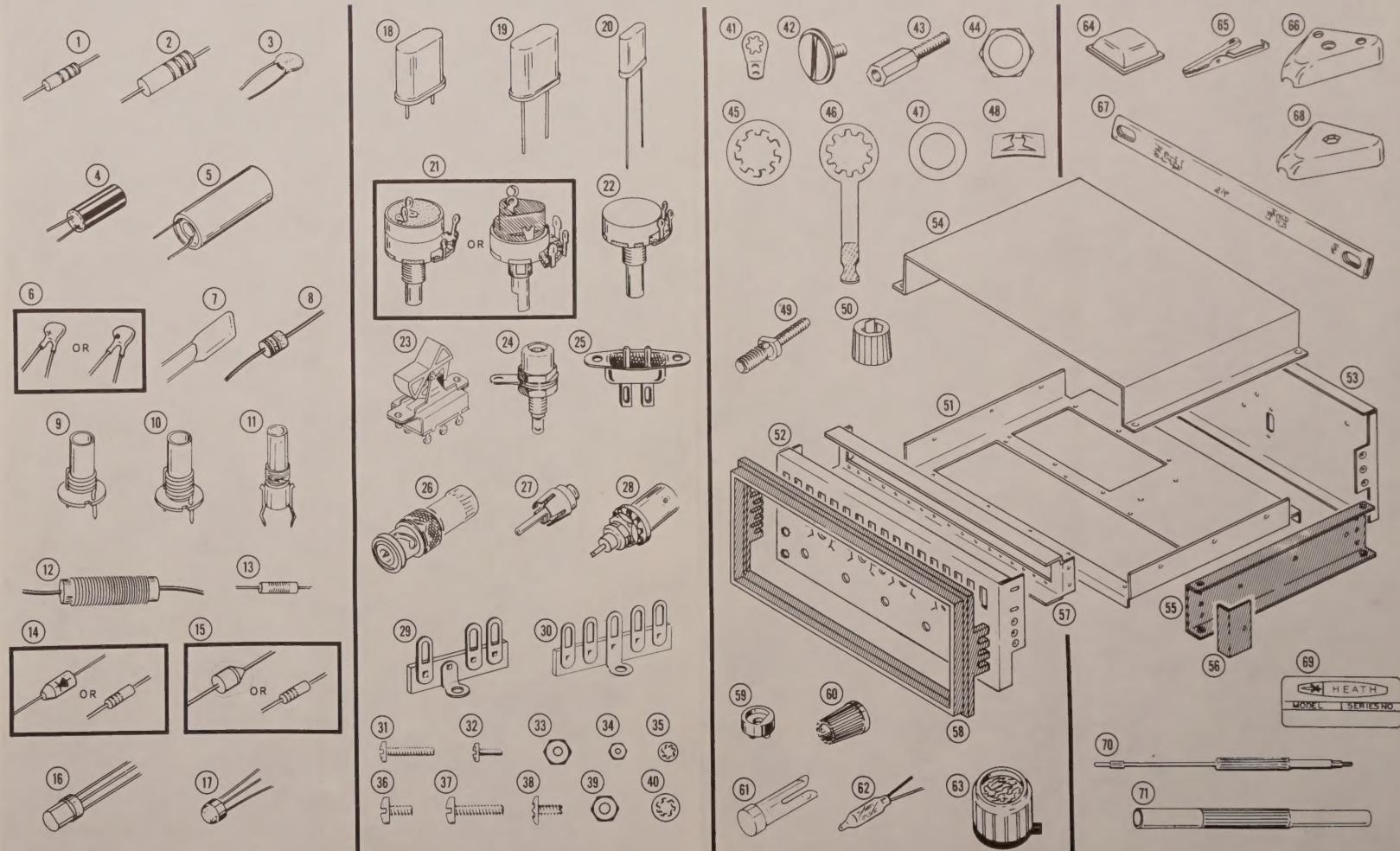
CONTINUE

(✓) 100 Ω (brown-black-brown).
(✓) 100 Ω (brown-black-brown).
(✓) 4.7 µH choke (#45-39).
(✓) 100 Ω (brown-black-brown).
(✓) 100 Ω (brown-black-brown).
(✓) 120 kΩ (brown-red-yellow).
(✓) 10 kΩ (brown-black-orange).
(✓) 68 kΩ (blue-gray-orange).
(✓) Solder all leads to the foil and cut off the excess lead lengths.
(✓) 1000 Ω (brown-black-red).
(✓) 10 kΩ (brown-black-orange).
(✓) 1000 Ω (brown-black-red).
(✓) 100 Ω 1 watt (brown-black-brown).
(✓) Zener diode (#56-32).
(✓) 100 Ω 1 watt (brown-black-brown).
(✓) Silicon diode (#57-27).
(✓) Solder all leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 2.

PICTORIAL 1

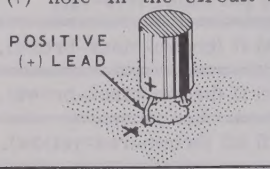
PARTS PICTORIAL



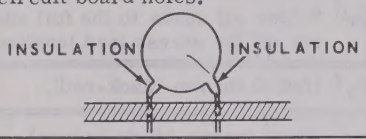
START

NOTE: Do not solder the leads until directed to do so in a step.

(✓) 5 μF electrolytic. NOTE: Always insert the positive (+) lead of the capacitor into the positive (+) hole in the circuit board.



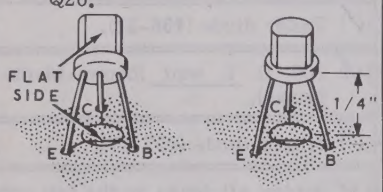
NOTE: Position the disc capacitors above the circuit board as shown. Do not push the insulation into the circuit board holes.



(✓) .01 μF disc.

(✓) .01 μF disc.

(✓) 2N3393 transistor (#417-118) at Q20.



(✓) .01 μF disc.

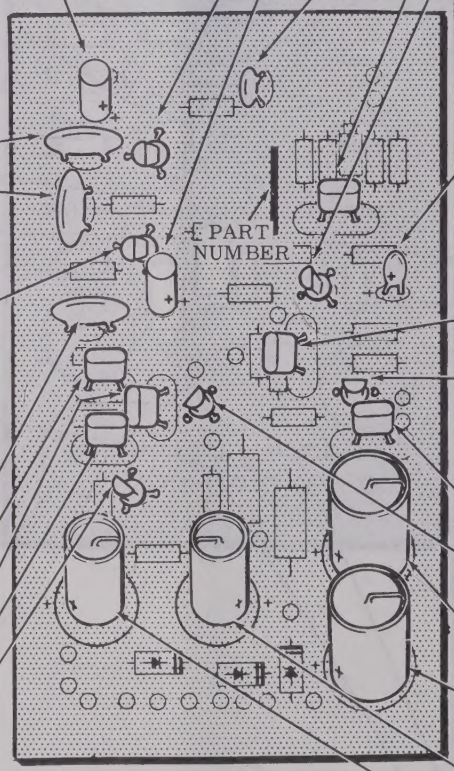
(✓) .047 μF Mylar.

(✓) .047 μF Mylar.

(✓) .047 μF Mylar.

(✓) 2N3393 transistor (#417-118) at Q22.

(✓) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

(✓) 2N3393 transistor (#417-118) at Q19 as shown.

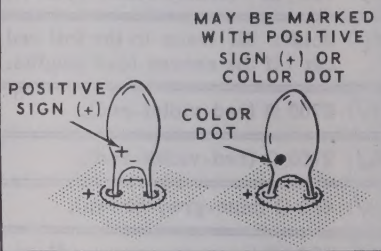
(✓) 5 μF electrolytic. Note position of positive lead.

(✓) .001 μF disc.

(✓) .1 μF Mylar.

(✓) 2N3393 transistor (#417-118) at Q17.

(✓) .68 μF 35 V Tantalum capacitor. NOTE: Position the positive (+) lead as shown.



(✓) .1 μF Mylar.

(✓) 2N3393 transistor (#417-118) at Q18.

(✓) Solder the leads to the foil and cut off the excess lead lengths.

(✓) .1 μF Mylar.

(✓) 2N3393 transistor (#417-118) at Q21.

(✓) 250 μF electrolytic. Note position of positive lead.

(✓) 250 μF electrolytic. Note position of positive lead.

(✓) 100 μF electrolytic. Note position of positive lead.

(✓) 100 μF electrolytic. Note position of positive lead.

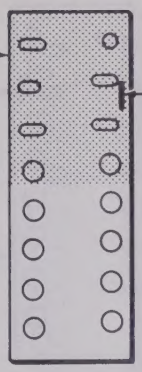
(✓) Solder all leads to the foil and cut off the excess lead lengths.

Set the amplifier circuit board aside. It will be used later.

PICTORIAL 2

PROCEED TO PICTORIAL 3.

The steps performed in this Pictorial are in this area of the circuit board.

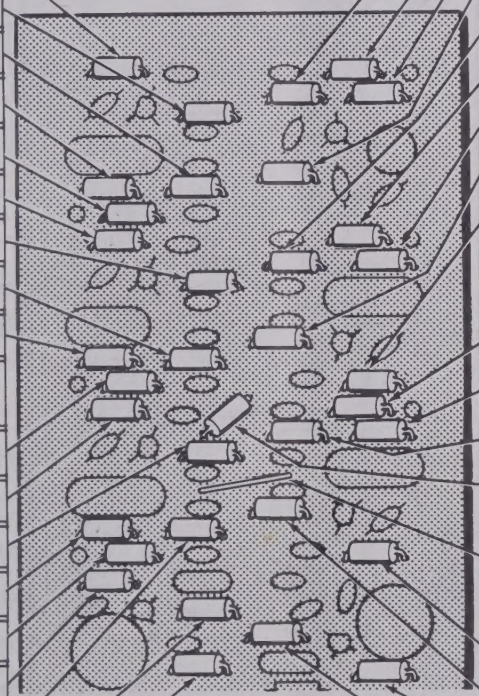


START

( ) Position the oscillator circuit board (#85-193-1) screened side up as shown in the following Pictorials.

NOTE: Do not solder the leads until directed to do so in a step.

(✓) 1500 Ω (brown-green-red).
(✓) 220 Ω (red-red-brown).
(✓) 8200 Ω (gray-red-red).
(✓) 47 kΩ (yellow-violet-orange).
(✓) 100 Ω (brown-black-brown).
(✓) 1500 Ω (brown-green-red).
(✓) 220 Ω (red-red-brown).
(✓) 8200 Ω (gray-red-red).
(✓) 47 kΩ (yellow-violet-orange).
(✓) Solder all leads to the foil and cut off the excess lead lengths.
(✓) 100 Ω (brown-black-brown).
(✓) 1500 Ω (brown-green-red).
(✓) 220 Ω (red-red-brown).
(✓) 47 kΩ (yellow-violet-orange).
(✓) 100 Ω (brown-black-brown).
(✓) 56 kΩ (green-blue-orange).
(✓) 8200 Ω (gray-red-red).
(✓) 4700 Ω (yellow-violet-red).
(✓) 220 Ω (red-red-brown).
(✓) Solder all leads to the foil and cut off the excess lead lengths.

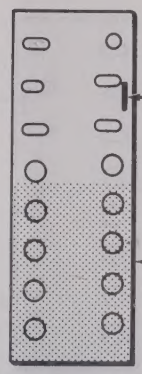


CONTINUE

(✓) 8200 Ω (gray-red-red).
(✓) 100 Ω (brown-black-brown).
(✓) 15 kΩ (brown-green-orange).
(✓) 1500 Ω (brown-green-red).
(✓) 8200 Ω (gray-red-red).
(✓) 100 Ω (brown-black-brown).
(✓) 47 kΩ (yellow-violet-orange).
(✓) 220 Ω (red-red-brown).
(✓) 1500 Ω (brown-green-red).
(✓) Solder all leads to the foil and cut off the excess lead lengths.
(✓) 100 Ω (brown-black-brown).
(✓) 47 kΩ (yellow-violet-orange).
(✓) 8200 Ω (gray-red-red).
(✓) 1000 Ω (brown-black-red).
(✓) Remove the insulation from a 1-1/4" white wire. Then install the bare wire at the location shown.
(✓) 1000 Ω (brown-black-red).
(✓) 220 Ω (red-red-brown).
(✓) 56 kΩ (green-blue-orange).
(✓) 220 Ω (red-red-brown).
(✓) Solder all leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 4.

PICTORIAL 3



START

NOTE: Do not solder the leads until directed to do so in a step.

(✓) 100 Ω (brown-black-brown).

(✓) 4700 Ω (yellow-violet-red).

(✓) 56 kΩ (green-blue-orange).

(✓) 220 Ω (red-red-brown).

(✓) 100 Ω (brown-black-brown).

(✓) 56 kΩ (green-blue-orange).

(✓) 4700 Ω (yellow-violet-red).

(✓) 220 Ω (red-red-brown).

(✓) 100 Ω (brown-black-brown).

(✓) Solder all leads to the foil and cut off the excess lead lengths.

(✓) 56 kΩ (green-blue-orange).

(✓) 4700 Ω (yellow-violet-red).

(✓) 220 Ω (red-red-brown).

(✓) 100 Ω (brown-black-brown).

(✓) 56 kΩ (green-blue-orange).

(✓) 4700 Ω (yellow-violet-red).

(✓) 220 Ω (red-red-brown).

(✓) 100 Ω (brown-black-brown).

(✓) Remove the insulation from a 1-1/4" white wire. Then install the bare wire at the location shown.

(✓) Solder all leads to the foil and cut off the excess lead lengths.

CONTINUE

(✓) 4700 Ω (yellow-violet-red).

(✓) 100 Ω (brown-black-brown).

(✓) 220 Ω (red-red-brown).

(✓) 4700 Ω (yellow-violet-red).

(✓) 56 kΩ (green-blue-orange).

(✓) 100 Ω (brown-black-brown).

(✓) 220 Ω (red-red-brown).

(✓) 56 kΩ (green-blue-orange).

(✓) 100 Ω (brown-black-brown).

(✓) Solder all leads to the foil and cut off the excess lead lengths.

(✓) 4700 Ω (yellow-violet-red).

(✓) 220 Ω (red-red-brown).

(✓) 56 kΩ (green-blue-orange).

(✓) 100 Ω (brown-black-brown).

(✓) 4700 Ω (yellow-violet-red).

(✓) 150 Ω (brown-green-brown).

(✓) 22 kΩ (red-red-orange).

(✓) 100 Ω (brown-black-brown).

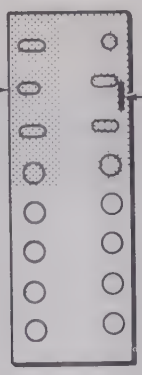
(✓) 6800 Ω (blue-gray-red).

(✓) Solder all leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 5.

PICTORIAL 4

The steps performed in this Pictorial are in this area of the circuit board.

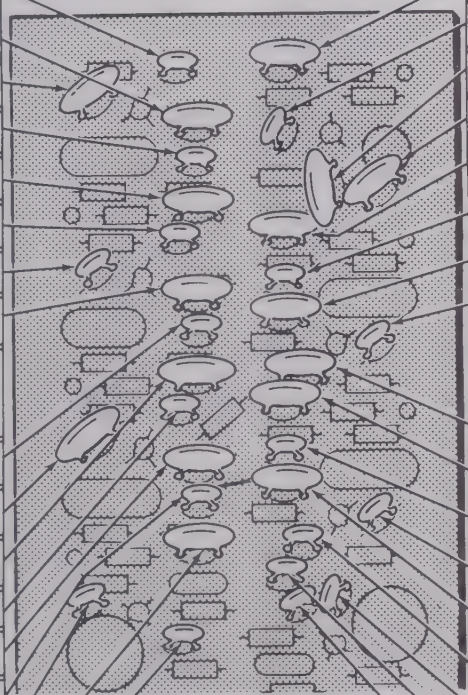


PART NUMBER

START

NOTE: Do not solder the leads until directed to do so in a step.

- (✓) 18 pF disc.
- (✓) .01 µF disc.
- (✓) 85 pF disc.
- (✓) 100 pF disc.
- (✓) .01 µF disc.
- (✓) 18 pF disc.
- (✓) 24 pF disc.
- (✓) .01 µF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.
- (✓) 100 pF disc.
- (✓) 85 pF disc.
- (✓) .01 µF disc.
- (✓) 18 pF disc.
- (✓) .01 µF disc.
- (✓) 100 pF disc.
- (✓) 33 pF disc.
- (✓) .01 µF disc.
- (✓) 10 pF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.

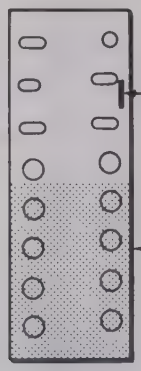


CONTINUE

- (✓) .01 µF disc.
- (✓) 500 pF disc.
- (✓) .003 µF disc.
- (✓) .003 pF disc.
- (✓) .01 µF disc.
- (✓) 100 pF disc.
- (✓) .01 µF disc.
- (✓) 24 pF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.
- (✓) 56 pF disc.
- (✓) .01 µF disc.
- ( ) 100 pF disc.
- (✓) 85 pF disc.
- (✓) .01 µF disc.
- (✓) 10 pF disc.
- (✓) 33 pF disc.
- (✓) .001 µF disc.
- (✓) 10 pF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 6

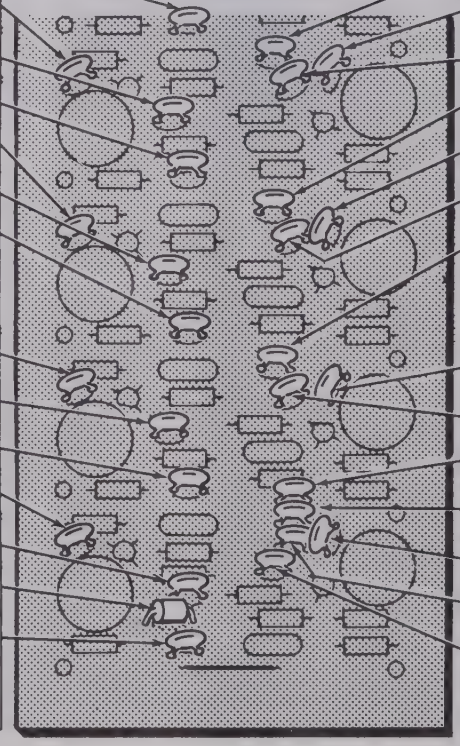
PICTORIAL 5



START

NOTE: Do not solder the leads until directed to do so in a step.

- (✓) .001 µF disc.
- (✓) 33 pF disc.
- (✓) 10 pF disc.
- (✓) .001 µF disc.
- (✓) 33 pF disc.
- (✓) 10 pF disc.
- (✓) .001 µF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.
- (✓) 24 pF disc.
- (✓) 10 pF disc.
- (✓) .001 µF disc.
- (✓) 47 pF disc.
- (✓) 18 pF disc.
- (✓) 1 pF phenolic.
- (✓) .001 µF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

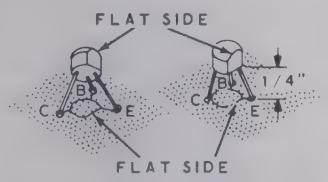
- (✓) .001 µF disc.
- (✓) 33 pF disc.
- (✓) 10 pF disc.
- (✓) .001 µF disc.
- (✓) 33 pF disc.
- (✓) 10 pF disc.
- (✓) .001 µF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.
- (✓) 24 pF disc.
- (✓) 10 pF disc.
- (✓) 24 pF disc.
- (✓) .001 µF disc.
- (✓) 24 pF disc.
- (✓) 5 pF disc.
- (✓) 20 pF disc.
- (✓) Solder all leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 7.

PICTORIAL 6

START

NOTE: Do not solder the leads until directed to do so in a step. Position each transistor 1/4" above the circuit board as shown below.



Insert the C, B, and E leads of the transistor into the corresponding C, B, and E holes in the circuit board.

( ) 2N3692 transistor (#417-108) at Q11.

( ) 2N3692 transistor (#417-108) at Q9.

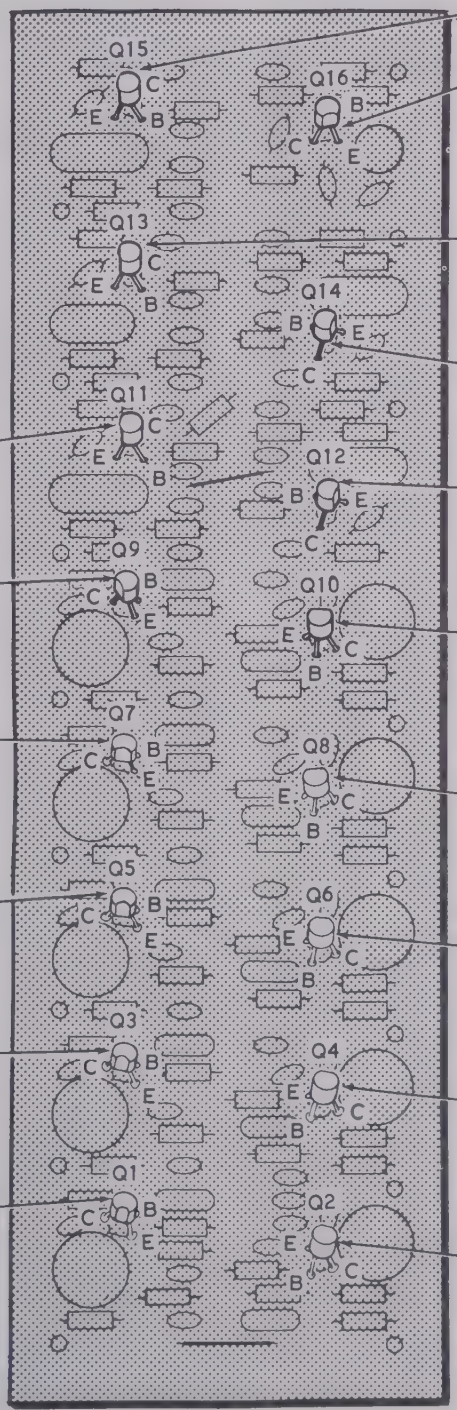
( ) 2N3692 transistor (#417-108) at Q7.

( ) 2N3692 transistor (#417-108) at Q5.

( ) 2N3692 transistor (#417-108) at Q3.

( ) 2N3692 transistor (#417-108) at Q1.

( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) 2N3692 transistor (#417-108) at Q15.

( ) 2N3692 transistor (#417-108) at Q16.

( ) 2N3692 transistor (#417-108) at Q13.

( ) 2N3692 transistor (#417-108) at Q14.

( ) 2N3692 transistor (#417-108) at Q12.

( ) 2N3692 transistor (#417-108) at Q10.

( ) 2N3692 transistor (#417-108) at Q8.

( ) 2N3692 transistor (#417-108) at Q6.

( ) 2N3692 transistor (#417-108) at Q4.

( ) 2N3692 transistor (#417-108) at Q2.

( ) Solder all leads to the foil and cut off the excess lead lengths.

PROCEED TO PICTORIAL 8.

PICTORIAL 7

START

NOTE: Solder the leads as each part is installed. Do not cut off the excess lead length unless directed to do so in a step. Do not bend the pins on the large crystals.

(√) 3.08 MHz large crystal (#404-332).

NOTE: The crystal to be installed in the next step may be marked 3.579 MHz or 3579.545 kHz.

( ) 3.579 MHz large crystal (#404-238) at location marked 3.58. Cut off the excess lead length.

(√) 4.080 MHz large crystal (#404-333).

(√) 39.750 MHz small crystal (#404-334). Cut off the excess lead lengths.

NOTE: When you install the oscillator coils, be sure the notch in the coil is positioned as shown on the circuit board. Do not cut off the excess lead lengths.

(√) Oscillator coil #40-479 (red).

(√) 42.170 MHz small crystal (#404-336). Cut off the excess lead lengths.

(√) Oscillator coil #40-479 (red).

(√) 42.750 MHz small crystal (#404-344). Cut off the excess lead lengths.

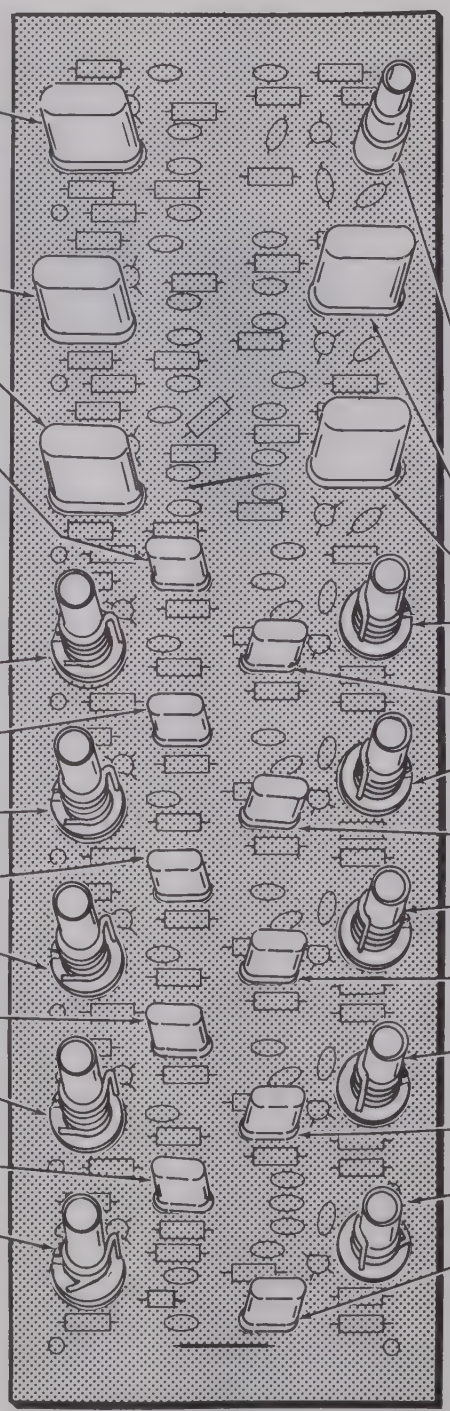
(√) Oscillator coil #40-479 (red).

(√) 45.750 MHz small crystal (#404-339). Cut off the excess lead lengths.

(√) Oscillator coil #40-479 (red).

(√) 67.250 MHz small crystal (#404-341). Cut off the excess lead lengths.

(√) Oscillator coil #40-478 (brown).



PICTORIAL 8

CONTINUE

NOTE: Do not bend the pins on the large crystals.

(√) Oscillator coil #40-820.

NOTE: The crystal to be installed in the next step may be marked 4.5 MHz or 4500 kHz.

(√) 4.5 MHz large crystal (#404-4).

(√) 10.7 MHz large crystal (#404-39).

(√) Oscillator coil #40-479 (red).

(√) 41.250 MHz small crystal (#404-335). Cut off the excess lead lengths.

(√) Oscillator coil #40-479 (red).

(√) 42.500 MHz small crystal (#404-337). Cut off the excess lead lengths.

(√) Oscillator coil #40-479 (red).

(√) 45.000 MHz small crystal (#404-338). Cut off the excess lead lengths.

(√) Oscillator coil #40-479 (red).

(√) 47.250 MHz small crystal (#404-340). Cut off the excess lead lengths.

(√) Oscillator coil #40-478 (brown).

(√) 96.625 MHz small crystal (#404-342). Cut off the excess lead lengths.

(√) Be sure all connections are properly soldered and that there are no solder bridges between the foils.

Set the oscillator circuit board aside. It will be used later.

FINISH

PROCEED TO PICTORIAL 9.

FRONT PANEL ASSEMBLY

The Heath Company has provided a plastic nut starter with this kit. Use this nut starter to pick up and start nuts on screws. Refer to Page 3 of the Kit Builders Guide for further information.

(✓) Refer to Pictorial 9, and mount the 17 rocker switches (#60-32) to the switch bracket (#204-811) using 4-40 screws. NOTE: Use the small end of the nut starter to insert the 4-40 screws.

Refer to Pictorial 10 (fold-out from Page 17) for the following steps.

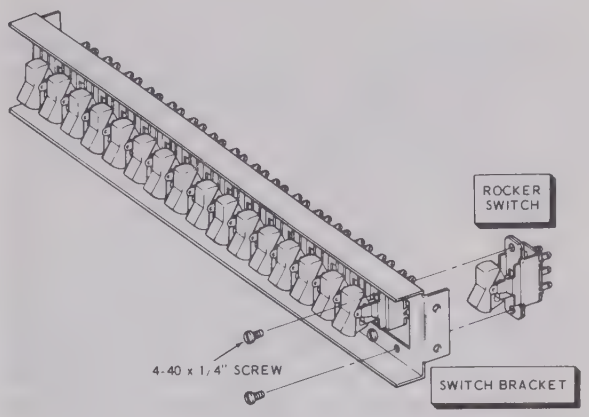
(✓) Position the front panel as shown in the Pictorial.

(✓) Refer to Detail 10A and mount the two binding post bases (#427-3), one at BH and the other at BJ as shown. Use two insulator bushings, a #6 solder lug, and two 6-32 nuts for each binding post base. Position the holes in each binding post base horizontally, and position the solder lug as shown in the Pictorial.

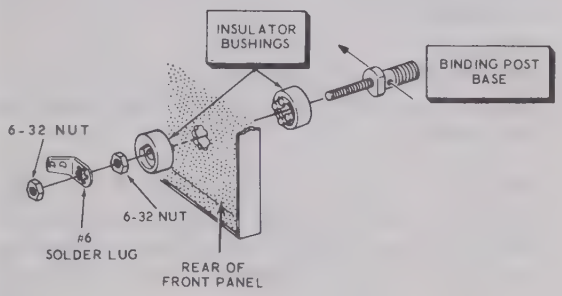
(✓) Thread the red binding post cap (#100-16-18) onto binding post BH, and the black binding post cap (#100-16-2) onto binding post BJ.

CAUTION: In the following step, the screwdriver head should be larger than the opening in the end of the metal binding post, but small enough to clear the hole in the plastic binding post cap.

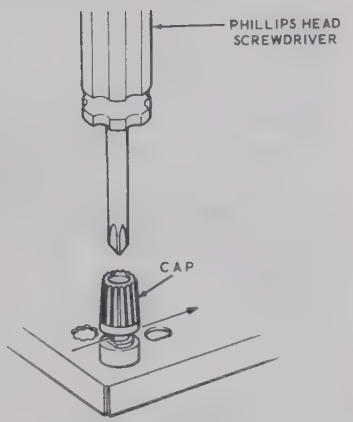
(✓) Refer to Detail 10B and tap a phillips head screwdriver with a hammer to enlarge the open end of the binding posts so that the binding post caps cannot be removed.



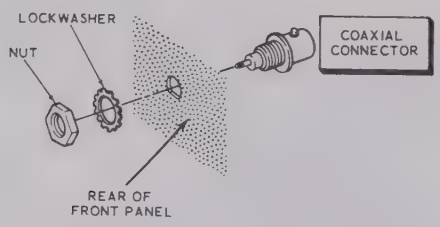
PICTORIAL 9



Detail 10A



Detail 10B



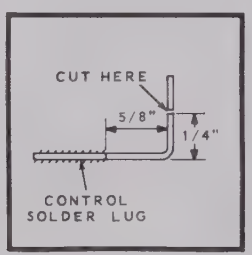
Detail 10C

(✓) Refer to Detail 10C and mount two female coaxial connectors (#432-59), one at BC and the other at BE. Use the hardware provided.

(✓) Mount a 100 Ω control (#10-225) at AX. Use a control lockwasher, control flat washer and control nut. Position the control as shown in the Pictorial.

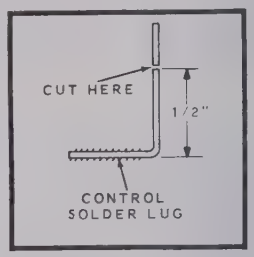
(✓) Refer to Detail 10D and prepare a control solder lug. Cut off the end of the solder lug as shown.

(✓) Mount a female coaxial connector at BD. Use the control solder lug just prepared in place of the supplied lockwasher. Position the solder lug as shown in the Pictorial.



Detail 10D

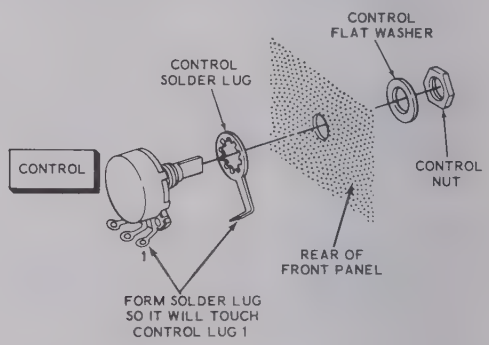
(✓) Refer to Detail 10E and prepare two control solder lugs. Cut the lug to the dimension shown in the Detail.



Detail 10E

(✓) Mount female coaxial connectors at BF and BG. Use the prepared control solder lugs instead of the control lockwashers supplied with each connector. Position the solder lugs as shown in the Pictorial.

(✓) Refer to Detail 10F and mount a 1 MΩ control (#10-224) at AY, with a control solder lug, control flat washer, and control nut. Form the solder lug so it touches lug 1 of control AY; then tighten the control nut.



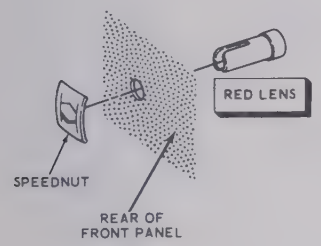
Detail 10F

(✓) In a similar manner, mount a 10 kΩ control (#10-223) at BA. Position the control as shown.

perform 1st. step on P. 15, first

(✓) Mount a 10 kΩ control with push-pull switch (#19-116) at BB. Use a control lockwasher, control flat washer, and control nut. Position the three control lugs as shown.

(✓) Refer to Detail 10G and mount the red lens (#413-10) at AZ with a speednut. Press the speednut firmly against the front panel.



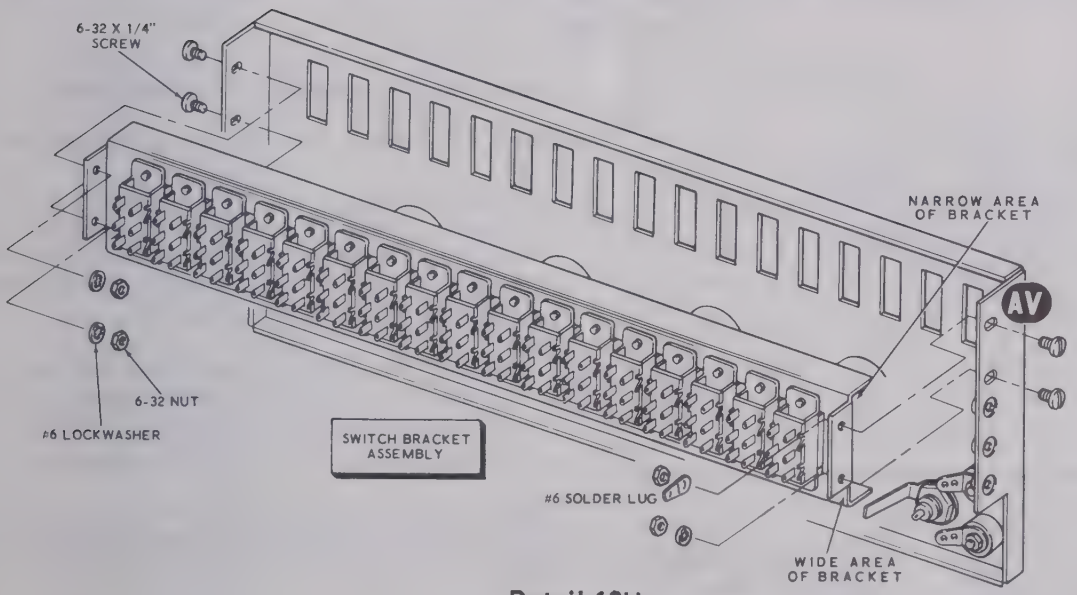
Detail 10G

NOTE: When hardware is called for, only the screw size is given. For instance, if 6-32 x 1/4" hardware is called for, it means that a 6-32 x 1/4" screw, one or more #6 lockwashers, and a 6-32 nut should be used for each mounting hole. The Detail referred to in the step shows the proper position and number of lockwashers. Do not use the phillips head screws until directed to do so in a step.

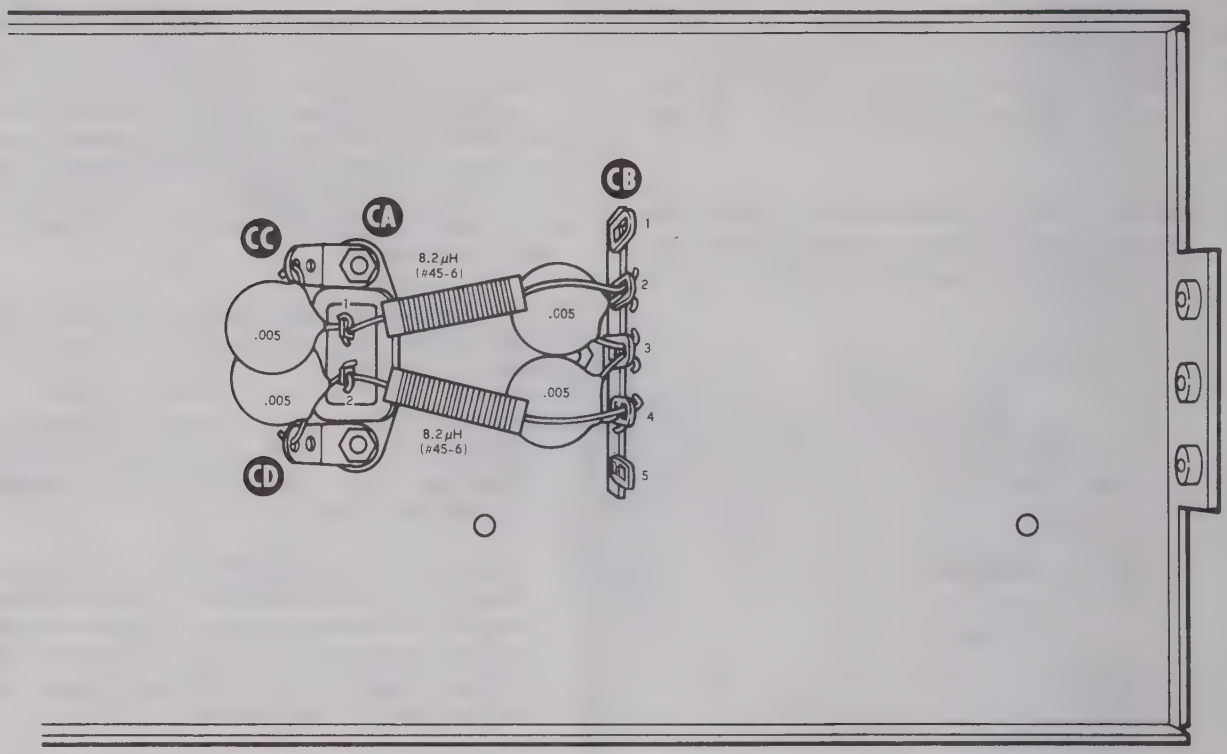
NOTE: In the next step, be sure the wide area of the bracket is positioned as shown in the Detail.

(✓) Refer to Detail 10H and mount the assembled switch bracket to the front using 6-32 x 1/4" hardware. Use a #6 solder lug at AV instead of a #6 lockwasher.

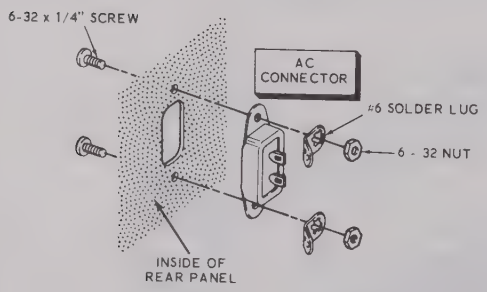
(✓) Check each switch to be sure it operates freely. If any switch binds, mark it; then remove the switch assembly and loosen the switch mounting screws. Reposition the switch, tighten its mounting screws, and replace the switch assembly.



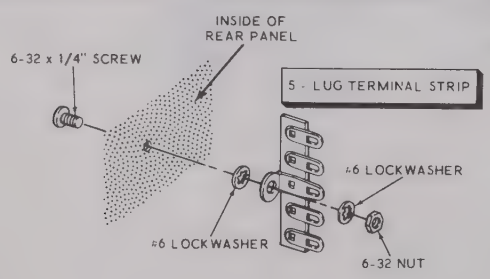
Detail 10H



PICTORIAL 11



Detail 11A



Detail 11B

REAR PANEL ASSEMBLY AND WIRING

Refer to Pictorial 11 for the following steps.

(√) Refer to Detail 11A and mount the AC connector (#432-4) on the rear panel at CA. Use two 6-32 x 1/4" screws, two #6 solder lugs, and two 6-32 nuts. Position the solder lugs as shown in the Pictorial.

(√) Refer to Detail 11B and mount a 5-lug terminal strip (#431-11) on the rear panel at CB with 6-32 x 1/4" hardware. Position the terminal strip as shown in the Pictorial.

NOTE: In the following steps, be sure the choke and capacitor leads do not touch the metal frame of connector CA.

(√) Connect a .005 µF 1.4 kV disc capacitor from solder lug CD (S-1) to lug 2 of connector CA (NS).

(√) Connect a .005 µF 1.4 kV disc capacitor from solder lug CC (S-1) to lug 1 of connector CA (NS).

(✓) Connect a .005 µF 1,4 kV disc capacitor between lug 4 (NS) and lug 3 (NS) of terminal strip CB.

(✓) Connect a .005 µF 1,4 kV disc capacitor between lug 3 (S-2) and lug 2 (NS) of terminal strip CB.

(✓) Connect an 8,2 µH choke (#45-6) from lug 2 of connector CA (S-2) to lug 4 of terminal strip CB (NS).

(✓) Connect an 8,2 µH choke (#45-6) from lug 1 of connector CA (S-2) to lug 2 of terminal strip CB (NS).

CHASSIS ASSEMBLY

Refer to Pictorial 12 (fold-out from Page 17) for the following steps.

(✓) Mount the amplifier (small) circuit board (#85-192-1) on the chassis so the four upright capacitors are nearest the center of the chassis. Use ~~6-32~~ 4-40 x 1/4" hardware.

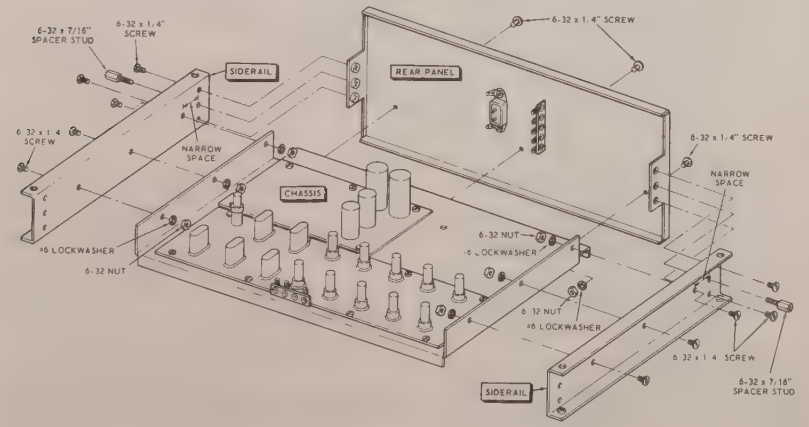
(✓) Position the oscillator circuit board (#85-193-1) on the chassis so the five screw holes on one edge of the circuit board line up with the five holes in the chassis. Use ~~6-32~~ 4-40 x 1/4" hardware with a 3-lug terminal strip (#431-3) on top of the circuit board at BK.

Refer to Pictorial 13 for the following steps.

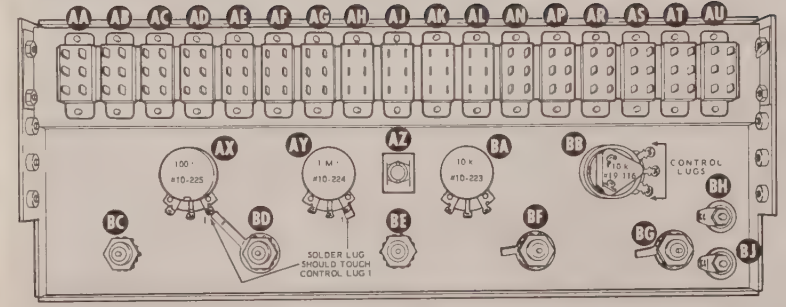
(✓) Mount the rear panel assembly to the chassis as shown in the Pictorial. Use 6-32 x 1/4" hardware at the three locations shown.

NOTE: Position the narrow spaced holes on each siderail toward the rear of the chassis as shown.

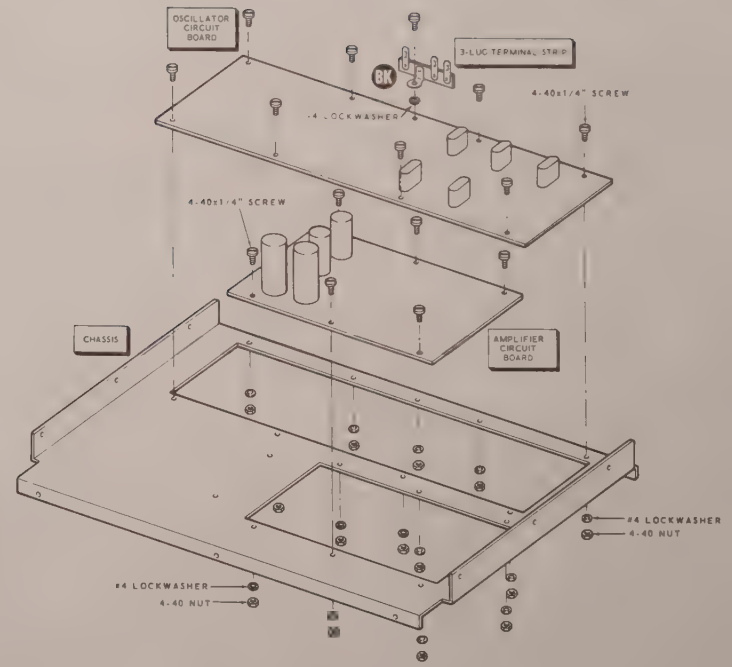
(✓) Mount the siderails to the rear panel and the chassis. Use five 6-32 x 1/4" screws, one 6-32 x 7/16" spacer stud and three #6 lockwashers on each side.



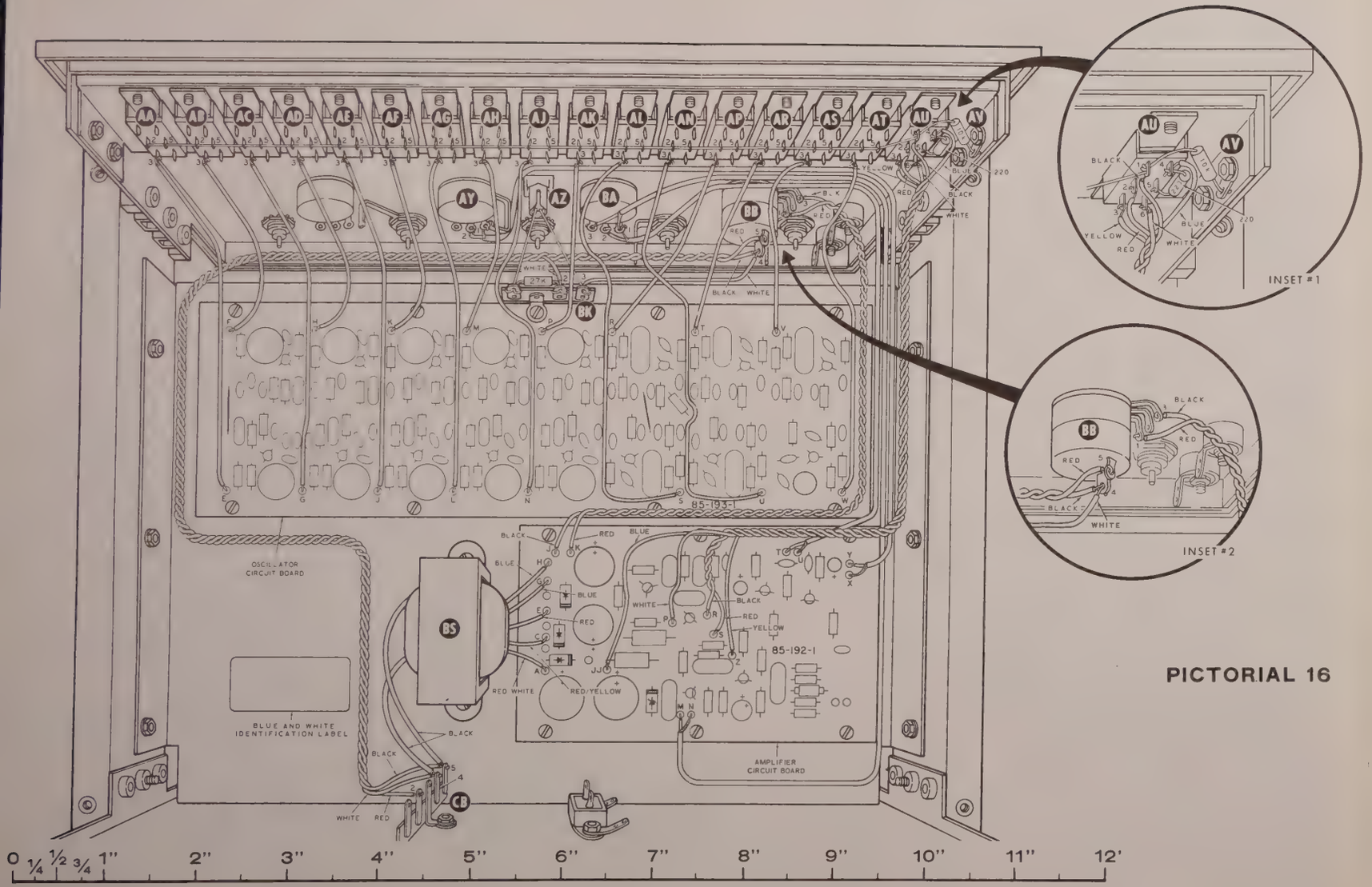
PICTORIAL 13



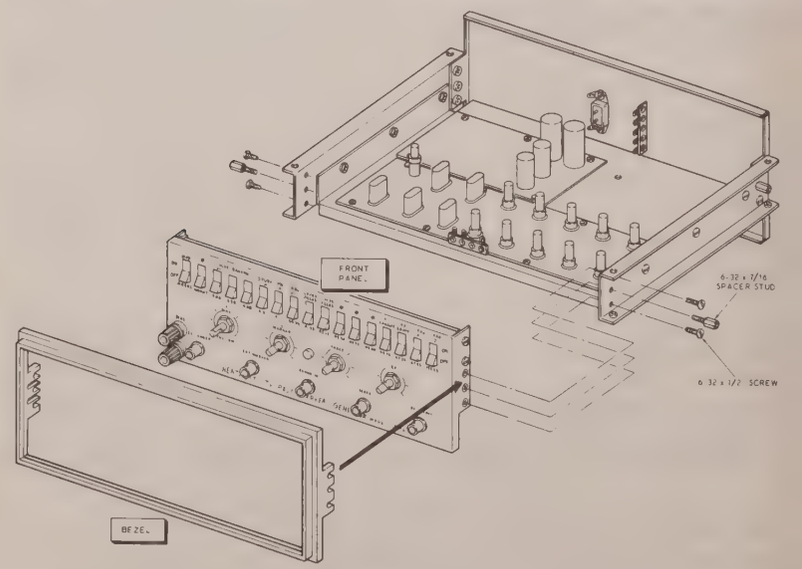
PICTORIAL 10



PICTORIAL 12



PICTORIAL 16



PICTORIAL 14

Refer to Pictorial 14 for the following steps.

(✓) Place the bezel over the front panel; then position the panel and bezel between the free ends of the siderails on the chassis.

(✓) Secure the panel and bezel to each siderail with two 6-32 x 1/2" screws and one 6-32 x 7/16" spacer stud at each end of the panel.

BOTTOM CHASSIS WIRING

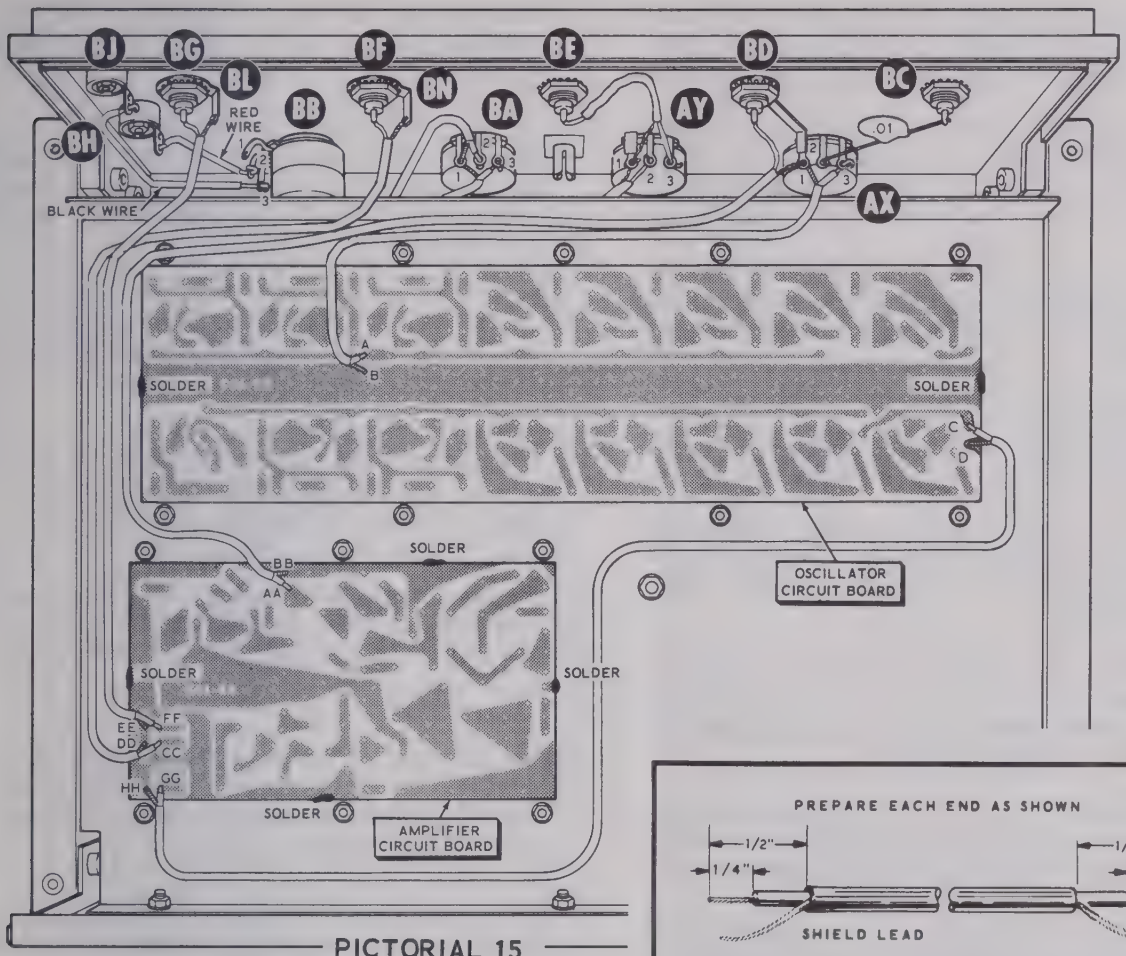
NOTE: Whenever possible, position the insulated wires down against the chassis. Form and position each wire to make the kit as neat as possible when it is completed.

Refer to Pictorial 15 for the following steps.

(✓) Solder the large circuit board to the chassis at the two locations indicated.

(✓) Solder the small circuit board to the chassis at the four locations indicated.

(✓) Connect a .01 μF disc capacitor from connector BC (S-1) to lug 2 of control AX (S-1).



PICTORIAL 15

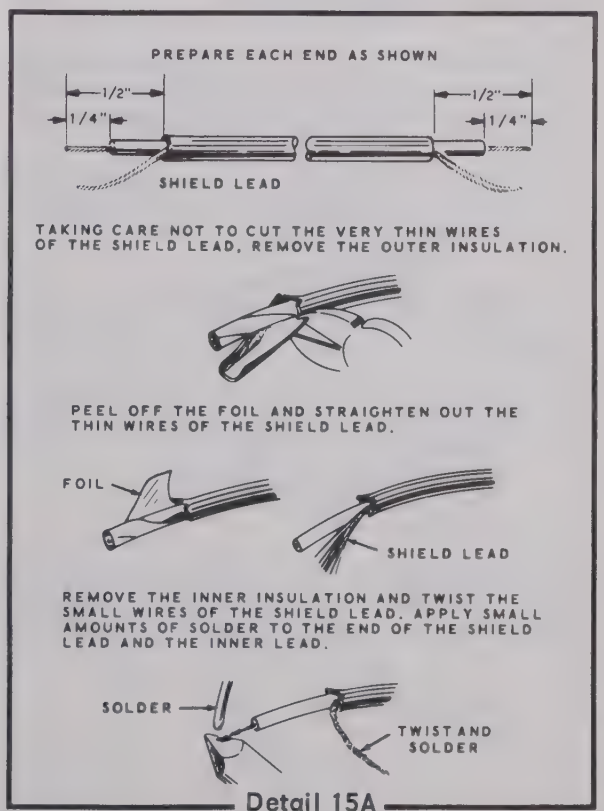
NOTE: Use hookup wire of the color specified when wire is called for in a step. Cut each wire to the proper length and remove 1/4" of insulation from each end. CAUTION: Do not use the heavy black or red stranded (test lead) wire until it is called for in a step.

(√) Connect a 4-1/2" black wire from binding post BJ (S-1) to lug 3 of control BB (NS).

(√) Connect a 2" red wire from binding post BH (S-1) to lug 2 of control BB (S-1).

(√) Refer to Detail 15A and prepare the following lengths of small coaxial cable:

10-1/2"	17"
12"	14-1/2"
12-1/2"	


PREPARE EACH END AS SHOWN
1/2"
1/4"
1/2"
1/4"
SHIELD LEAD
TAKING CARE NOT TO CUT THE VERY THIN WIRES OF THE SHIELD LEAD, REMOVE THE OUTER INSULATION.
PEEL OFF THE FOIL AND STRAIGHTEN OUT THE THIN WIRES OF THE SHIELD LEAD.
FOIL
SHIELD LEAD
REMOVE THE INNER INSULATION AND TWIST THE SMALL WIRES OF THE SHIELD LEAD. APPLY SMALL AMOUNTS OF SOLDER TO THE END OF THE SHIELD LEAD AND THE INNER LEAD.
SOLDER
TWIST AND SOLDER

Detail 15A

NOTE: After you have connected a coaxial cable in the following steps, be sure the shield lead does not touch any adjacent lug or connection.

( ) At one end of the 10-1/2" coaxial cable, connect the inner lead to connector BG (S-1), and the shield lead to control solder lug BL (S-1).

( ) At the free end of this cable, connect the inner lead to hole FF (S-1) and the shield lead to hole EE (S-1) in the amplifier circuit board.

( ) At one end of the 12" coaxial cable, connect the inner lead to connector BF (S-1), and the shield lead to control solder lug BN (S-1).

( ) At the free end of this cable, connect the inner lead to hole CC (S-1), and the shield lead to hole DD (S-1) in the amplifier circuit board.

NOTE: After you have performed the following three steps, position the free ends of the three coaxial cables toward the top of the chassis. They will be connected later.

( ) At one end of the 12-1/2" coaxial cable, connect the inner lead to lug 2 (S-1) and the shield lead to lug 1 (NS) of control BA.

( ) At one end of the 17" coaxial cable, connect the inner lead to lug 3 (S-1) and the shield lead to lug 1 (S-2) of control BA.

( ) At one end of the 14-1/2" coaxial cable, connect the inner lead to lug 2 (S-1) and the shield lead to lug 1 (NS) of control AY.

( ) Again refer to Detail 15A and prepare the following lengths of small coaxial cable:

2-1/2"	16-1/2"
10"	

( ) At one end of the 2-1/2" coaxial cable, connect the inner lead to lug 3 (S-1) and the shield lead to lug 1 (NS) of control AY.

( ) Now solder the two shield leads and the control solder lug to lug 1 of control AY (S-3).

( ) Connect the inner lead at the free end of this 2-1/2" coaxial cable to connector BE (S-1). Cut off the shield lead as it will not be used.

( ) At one end of the 10" coaxial cable, connect the inner lead to lug 3 (S-1) and the shield lead to lug 1 (NS) of control AX.

perform after 9II, AOP

( ) Now solder the two shield leads and the solder lug coming from connector BD to lug 1 of control AX (S-3).

( ) At the other end of this 10" coaxial cable, connect the inner lead to hole A (S-1) and the shield lead to hole B (S-1) in the oscillator circuit board.

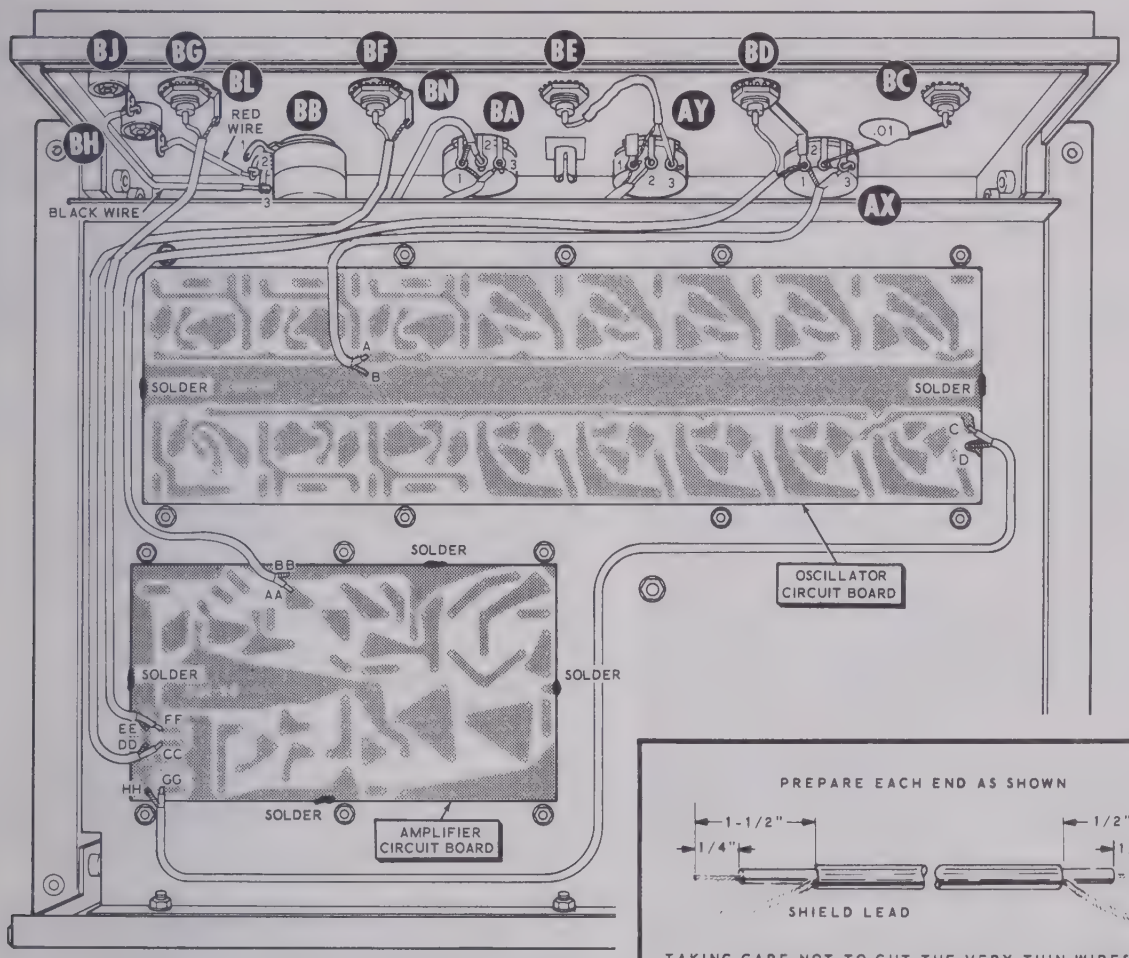
( ) At one end of the 16-1/2" coaxial cable, connect the inner lead to hole C (S-1) and the shield lead to hole D (S-1) in the oscillator circuit board.

( ) At the other end of this cable, connect the inner lead to hole GG (S-1) and the shield lead to hole HH (S-1) in the amplifier circuit board.

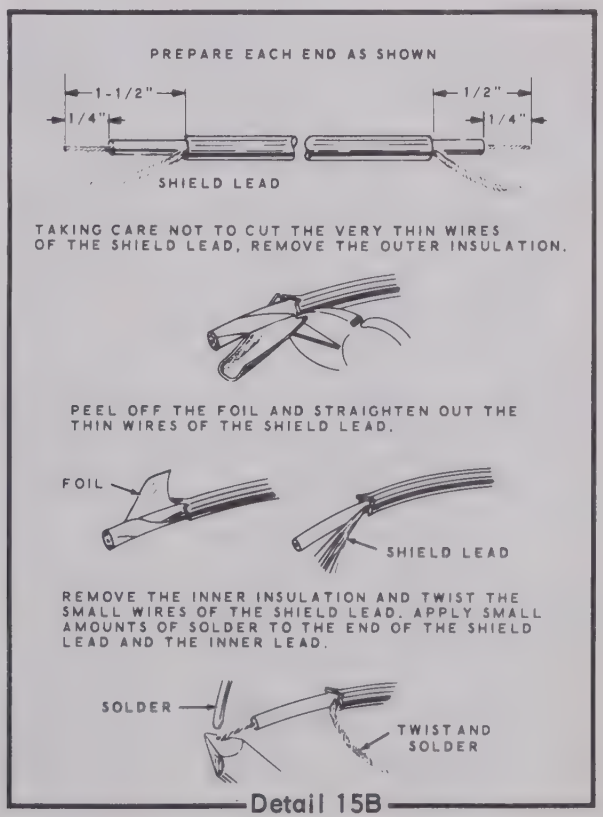
( ) Refer to Detail 15B and prepare a ~~15~~ 16 -1/2" length of small coaxial cable.

9 ( ) At the end of this cable with the most insulation removed, connect the inner lead to connector BD (S-1), and the shield lead to lug 1 of control AX (NS).

( ) At the free end of this cable, connect the inner lead to hole AA (S-1) and the shield lead to hole BB (S-1) in the amplifier circuit board.



PICTORIAL 15
(Repeat)


PREPARE EACH END AS SHOWN
1-1/2"
1/4"
1/2"
1/4"
SHIELD LEAD
TAKING CARE NOT TO CUT THE VERY THIN WIRES OF THE SHIELD LEAD, REMOVE THE OUTER INSULATION.
PEEL OFF THE FOIL AND STRAIGHTEN OUT THE THIN WIRES OF THE SHIELD LEAD.
FOIL
SHIELD LEAD
REMOVE THE INNER INSULATION AND TWIST THE SMALL WIRES OF THE SHIELD LEAD. APPLY SMALL AMOUNTS OF SOLDER TO THE END OF THE SHIELD LEAD AND THE INNER LEAD.
SOLDER
TWIST AND SOLDER

Detail 15B

TOP CHASSIS WIRING

Refer to Pictorial 16 (fold-out from Page 18) for the following steps.

NOTE: In the following steps, the wires and coaxial cables will be soldered to the foil side of the circuit boards.

( ) Locate the free end of the 14-1/2" cable coming from control AY. Connect the inner lead to hole Y (S-1) and the shield lead to hole X (S-1) in the amplifier circuit board.

( ) Locate the free end of the 17" cable coming from lugs 1 and 3 of control BA. Connect the inner lead to hole M (S-1) and the shield lead to hole N (S-1) in the amplifier circuit board.

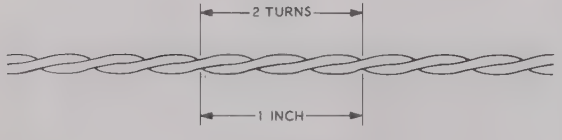
( ) Locate the free end of the 12-1/2" cable coming from control BA. Connect the inner lead to hole T (S-1) and the shield lead to hole U (S-1) in the amplifier circuit board.

NOTE: When wiring this kit, you will be instructed to prepare the lengths of hookup wire ahead of time as in the following step. Cut each wire to the indicated length and remove 1/4" of insulation from each end. The wires are listed in the order in which they will be used.

( ) Prepare the following lengths of hookup wire:

12-1/2"	red	23"	black
12-1/2"	black	24"	red
3-1/2"	white	20"	white

( ) Refer to Detail 16A and twist together the 12-1/2" red wire and the 12-1/2" black wire. The wires should be twisted approximately two turns per inch.



Detail 16A

( ) At one end of the twisted pair, connect the red wire to lug 1 (S-1) and black wire to lug 3 (S-2) of control BB.

( ) At the other end of the twisted pair, connect the red wire to hole K (S-1) and the black wire to hole J (S-1) in the amplifier circuit board.

( ) Connect a 3-1/2" white wire from lug 4 of control BB (NS) to lug 3 of terminal strip BK (NS).

( ) Again refer to Detail 16A and twist together a 23" black wire, a 24" red wire, and a 20" white wire so the three wires are even at one end.

( ) Connect the end where all three wires are even to terminal strip CB as follows:

( ) Black to lug 5 (NS).

( ) White to lug 4 (NS).

( ) Red to lug 2 (S-3).

( ) At the other end of the 3-wire twisted cable, connect the white wire to lug 2 of terminal strip BK (NS).

( ) Connect the black wire of the 3-wire twisted cable to lug 4 (S-2) and the red wire to lug 5 (S-1) of control BB.

( ) Connect a 27 kΩ (red-violet-orange) resistor between lug 1 (NS) and lug 2 (S-2) of terminal strip BK.

( ) Insert the neon lamp into the red lens at AZ as far as it will go.

CAUTION: Be sure that the neon lamp leads do not touch each other after you perform the next two steps.

( ) Connect either one of the lamp leads to lug 1 of terminal strip BK (S-2).

( ) Connect the remaining lamp lead to lug 3 of terminal strip BK (S-2).

(✓) Remove all of the insulation from a 10-1/2" length of black wire.

(✓) Insert this bare wire through lugs 2 (NS) and 5 (NS) of rocker switches AA through AT, and through lug 1 (NS) of rocker switch AU.

NOTE: Where a wire passes through a connection and then goes to another point, as in the next step, it will count as two wires in the solder instructions (S-2), one entering and one leaving the connection.

(✓) Now solder lug 2 (S-2) and lug 5 (S-2) on each rocker switch AA through AT. Do not solder lug 1 of rocker switch AU. NOTE: Cut off the excess lead length at switch AA.

(✓) Connect a 220 Ω (red-red-brown) resistor from lug 4 (NS) to lug 5 (S-1) of rocker switch AU.

(✓) Connect a 10 kΩ (brown-black-orange) resistor from lug 1 of rocker switch AU (NS) to solder lug AV (S-1).

(✓) Prepare the following lengths of hookup wire:

11-1/2" white	13" blue
11" yellow	10-3/4" black
11" red	

(✓) Place these five wires together so their ends are even at one end. Then twist them together as shown in Detail 16A. Connect the end where all five wires are even to rocker switch AU as follows:

(✓) Yellow to lug 3 (S-1).

(✓) White to lug 6 (S-1).

(✓) Red to lug 2 (S-1).

(✓) Black to lug 1 (S-3).

(✓) Blue to lug 4 (S-2).

Connect the other end of this 5-wire cable to the amplifier circuit board as follows:

(✓) Yellow to hole Z (S-1).

(✓) Red to hole S (S-1).

(✓) Black to hole R (S-1).

(✓) White to hole P (S-1).

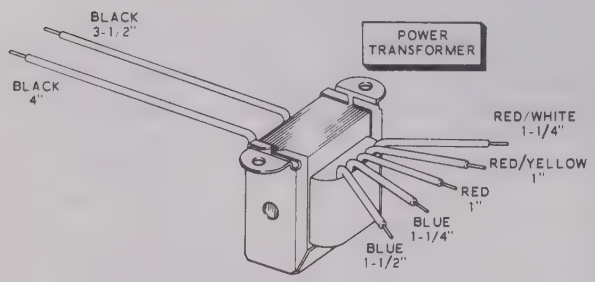
(✓) Blue to hole JJ (S-1).

Prepare and connect the proper length of red hookup wire called for in each step of the following chart. Position each wire as shown in Pictorial 16 (fold-out from Page 18).

	Wire length:	From lug 3 of rocker switch.	To oscillator circuit board hole.
(✓)	5-1/2"	AA (S-1)	E (S-1)
(✓)	3"	AB (S-1)	F (S-1)
(✓)	5-1/2"	AC (S-1)	G (S-1)
(✓)	3"	AD (S-1)	H (S-1)
(✓)	5-1/2"	AE (S-1)	J (S-1)
(✓)	3"	AF (S-1)	K (S-1)
(✓)	5-1/2"	AG (S-1)	L (S-1)
(✓)	3"	AH (S-1)	M (S-1)
(✓)	5-1/4"	AJ (S-1)	N (S-1)
(✓)	2-3/4"	AK (S-1)	P (S-1)
(✓)	6-3/4"	AL (S-1)	S (S-1)
(✓)	7-1/4"	AN (S-1)	U (S-1)
(✓)	3-1/2"	AP (S-1)	R (S-1)
(✓)	2-3/4"	AR (S-1)	T (S-1)
(✓)	2-3/4"	AS (S-1)	V (S-1)
(✓)	6-1/2"	AT (S-1)	W (S-1)

CAUTION: Be careful that you do not cut into the stranded wires when removing insulation. To avoid damage to internal connections, hold the wire where it comes out of the transformer as you remove the insulation from the ends of the transformer leads.

(✓) Refer to Detail 16B and cut the leads of the power transformer to the lengths indicated. Measure the leads from where they come out of the transformer.



Detail 16B

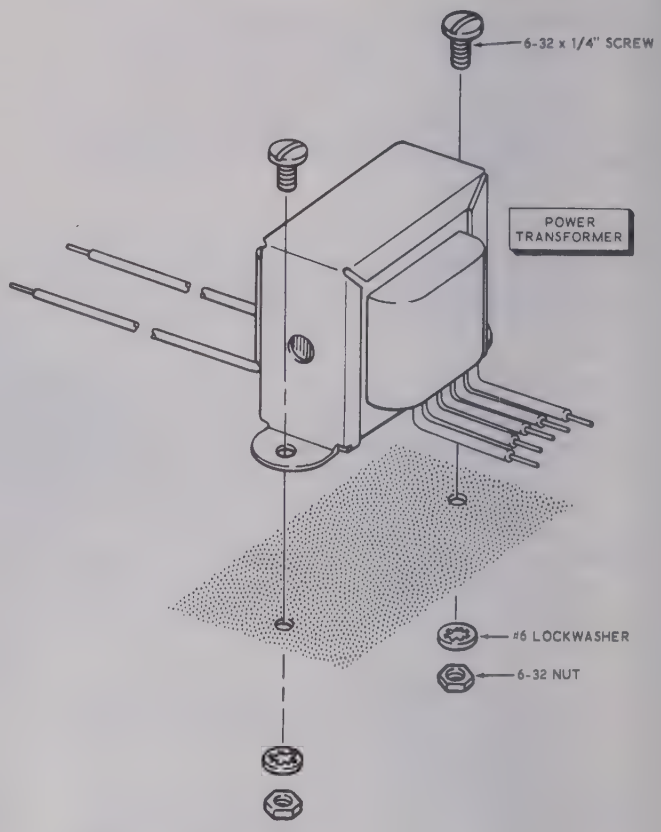
(✓) Remove 1/4" of insulation from the end of each transformer lead. Twist together the small strands of wire at the end of each lead; then apply a small amount of solder to the tip of each exposed lead.

NOTE: When mounting the power transformer, be sure the colored leads extend toward the amplifier circuit board.

(✓) Refer to Detail 16C and mount the power transformer at BS. Use 6-32 x 1/4" hardware.

Connect the power transformer leads to the amplifier circuit board holes as follows:

LEAD COLOR	CONNECT TO HOLE
(✓) Long blue	H (S-1).
(✓) Short blue	G (S-1).
(✓) Red	E (S-1).
(✓) Red/yellow	C (S-1).
(✓) Red/white	A (S-1).



Detail 16C

LEAD COLOR	CONNECT TO

NOTE: Circuit board holes B, D, F, L, V, and W will not be used.

(✓) Long black — lug 5 terminal strip CB (S-2).

(✓) Short black — lug 4 terminal strip CB (S-4).

NOTE: The blue and white label that is installed in the next step shows the Model number and Production Series number of your kit. Refer to these numbers in all communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

(✓) Remove the backing from the blue and white label. Then press the label onto the chassis as shown.

INSTALLING KNOBS

NOTE: The knobs in this kit use a bushing that must be pressed into the knob before the knob is permanently mounted on the shaft of a control.

Perform the following steps very carefully, since it is difficult to remove the bushing after it has been pressed into the knob.

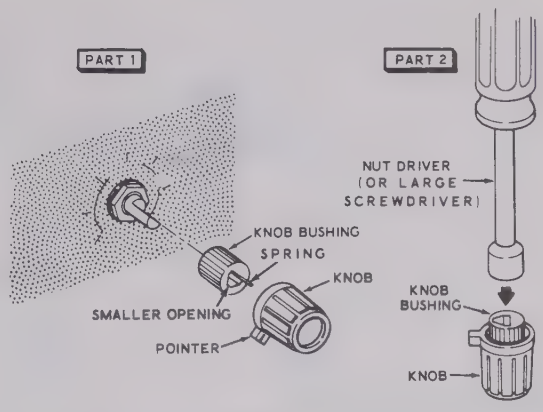
Refer to Pictorial 17 for the following steps.

NOTE: Each knob is aligned with a specific panel marking. Whenever you remove a knob, be sure to replace it on the same control shaft.

(✓) Refer to Part 1 of Detail 17A and push a knob bushing onto each of the four control shafts. Then turn all control shafts to their full counterclockwise positions.

CAUTION: Be sure you turn each control shaft fully counterclockwise and line up the knob pointer with the correct panel marking before you start the knob onto its bushing.

(✓) Line up the pointer with the full counterclockwise marking on the panel. Then press a control knob part way onto the bushing on the Bias control shaft.

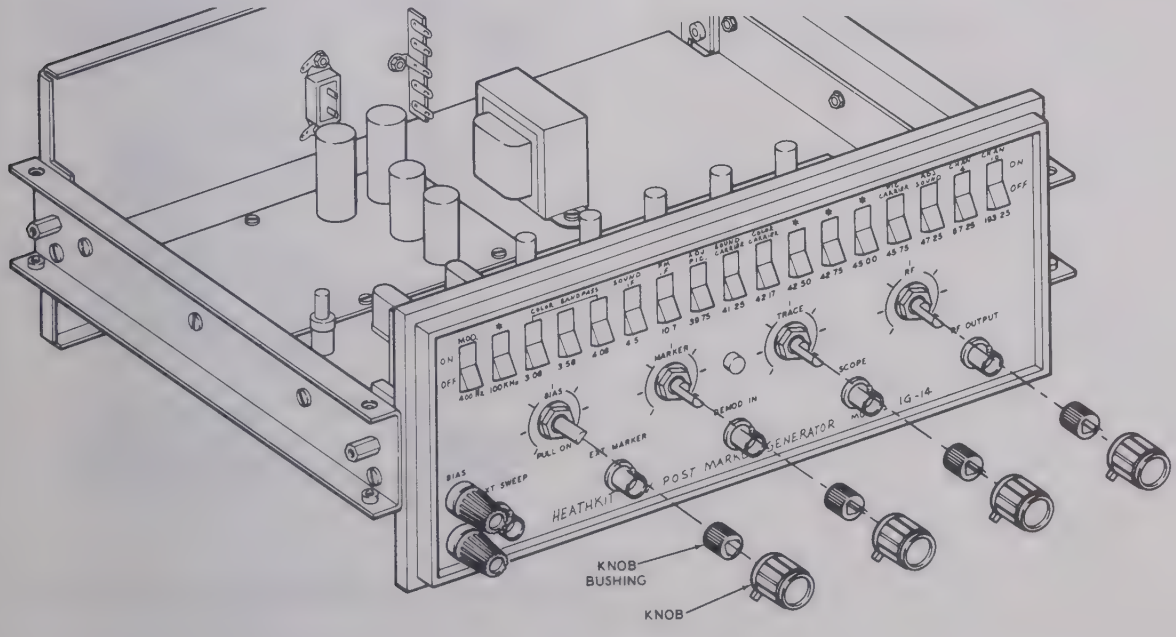


Detail 17A

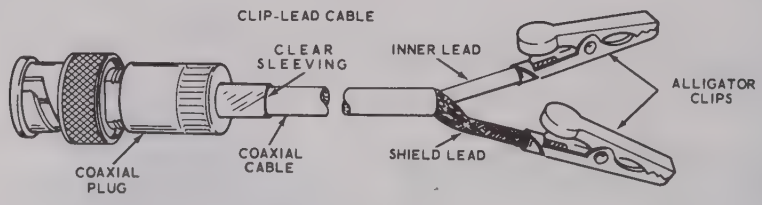
(✓) Now carefully remove both the knob bushing and the knob. Do not allow the knob to come off of the bushing.

(✓) Refer to Part 2 of Detail 17A and place the knob and bushing on a table, or other solid surface. Then use a nut driver (or a large screwdriver) to drive the bushing all the way into the knob. Place a soft cloth under the knob to prevent it from being scratched.

(✓) Repeat the above steps and insert a bushing into each of the three remaining knobs.



PICTORIAL 17

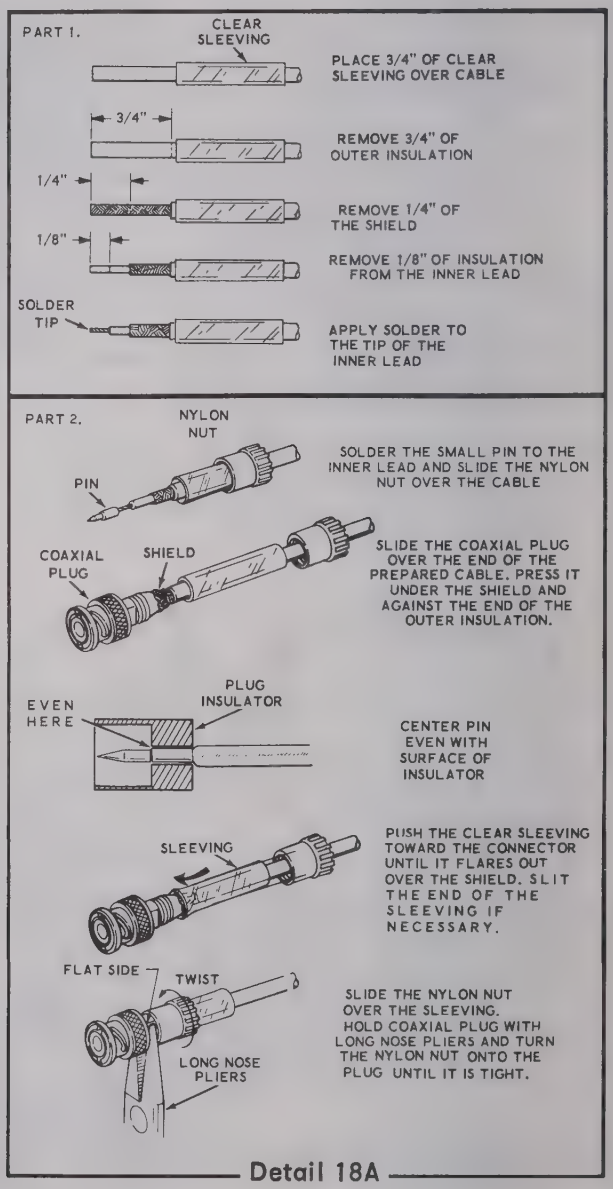


PICTORIAL 18

PREPARING CABLES

Refer to Pictorial 18 for the following steps.

(√) Refer to Part 1 of Detail 18A and prepare one end of each 3-foot coaxial cable as shown.


PART 1.
CLEAR SLEEVING
PLACE 3/4" OF CLEAR SLEEVING OVER CABLE
3/4"
REMOVE 3/4" OF OUTER INSULATION
1/4"
REMOVE 1/4" OF THE SHIELD
1/8"
REMOVE 1/8" OF INSULATION FROM THE INNER LEAD
SOLDER TIP
APPLY SOLDER TO THE TIP OF THE INNER LEAD
PART 2.
NYLON NUT
PIN
SOLDER THE SMALL PIN TO THE INNER LEAD AND SLIDE THE NYLON NUT OVER THE CABLE
COAXIAL PLUG
SHIELD
SLIDE THE COAXIAL PLUG OVER THE END OF THE PREPARED CABLE. PRESS IT UNDER THE SHIELD AND AGAINST THE END OF THE OUTER INSULATION.
EVEN HERE
PLUG INSULATOR
CENTER PIN EVEN WITH SURFACE OF INSULATOR
SLEEVING
PUSH THE CLEAR SLEEVING TOWARD THE CONNECTOR UNTIL IT FLARES OUT OVER THE SHIELD. SLIT THE END OF THE SLEEVING IF NECESSARY.
FLAT SIDE
TWIST
LONG NOSE PLIERS
SLIDE THE NYLON NUT OVER THE SLEEVING. HOLD COAXIAL PLUG WITH LONG NOSE PLIERS AND TURN THE NYLON NUT ONTO THE PLUG UNTIL IT IS TIGHT.

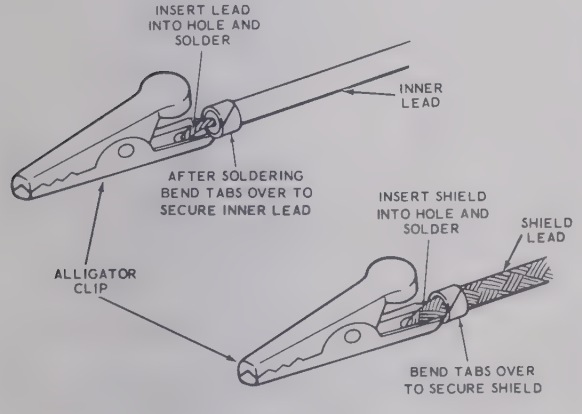
Detail 18A

NOTE: Be sure you do not lose the small center-pin when you open the envelope containing the coaxial plug.

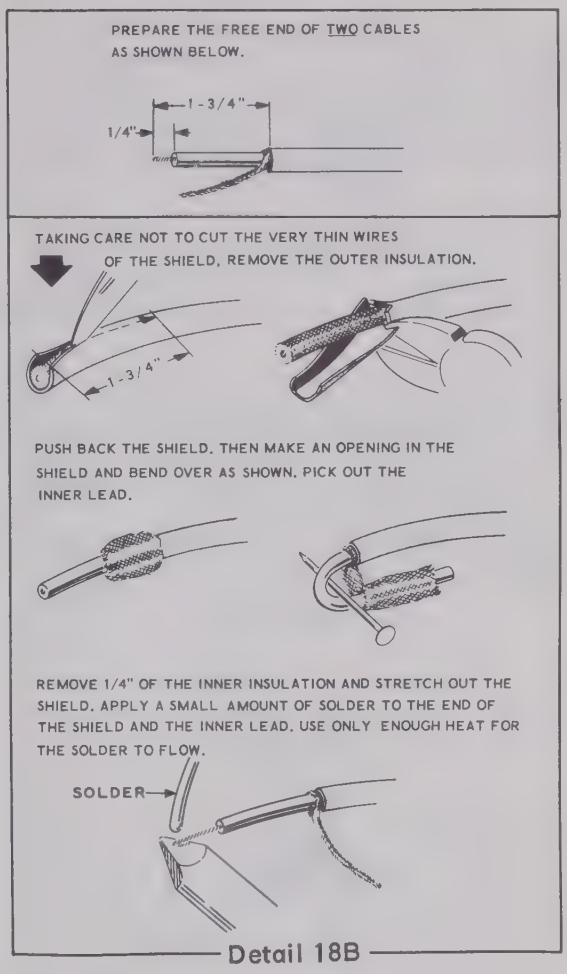
(✓) Refer to Part 2 of Detail 18A and install a coaxial plug (#432-58) on the prepared end of each cable. NOTE: The flange of the center pin should be even with the front surface of the plug.

(✓) Refer to Detail 18B and prepare the free end of <u>two</u> of the coaxial cables as shown.

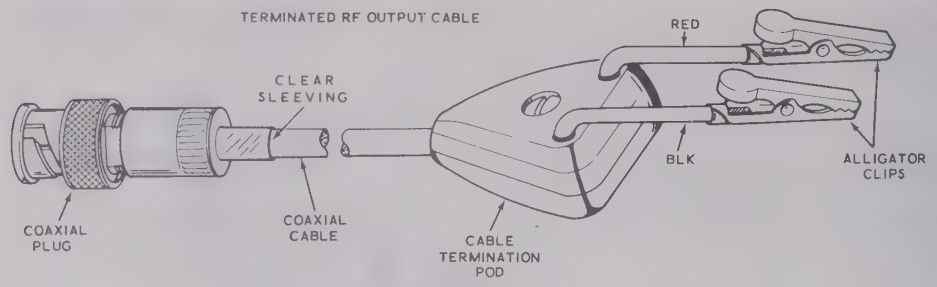
(✓) Refer to Detail 18C and install an alligator clip on the inner lead and shield lead of each of these <u>two</u> coaxial cables.


INSERT LEAD INTO HOLE AND SOLDER
INNER LEAD
AFTER SOLDERING BEND TABS OVER TO SECURE INNER LEAD
INSERT SHIELD INTO HOLE AND SOLDER
SHIELD LEAD
ALLIGATOR CLIP
BEND TABS OVER TO SECURE SHIELD

Detail 18C


PREPARE THE FREE END OF TWO CABLES AS SHOWN BELOW.
1 - 3/4"
1/4"
TAKING CARE NOT TO CUT THE VERY THIN WIRES OF THE SHIELD, REMOVE THE OUTER INSULATION.
1 - 3/4"
PUSH BACK THE SHIELD. THEN MAKE AN OPENING IN THE SHIELD AND BEND OVER AS SHOWN. PICK OUT THE INNER LEAD.
REMOVE 1/4" OF THE INNER INSULATION AND STRETCH OUT THE SHIELD. APPLY A SMALL AMOUNT OF SOLDER TO THE END OF THE SHIELD AND THE INNER LEAD. USE ONLY ENOUGH HEAT FOR THE SOLDER TO FLOW.
SOLDER

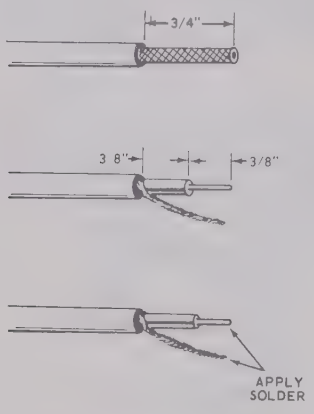
Detail 18B



PICTORIAL 19

Refer to Pictorial 19 for the following steps.

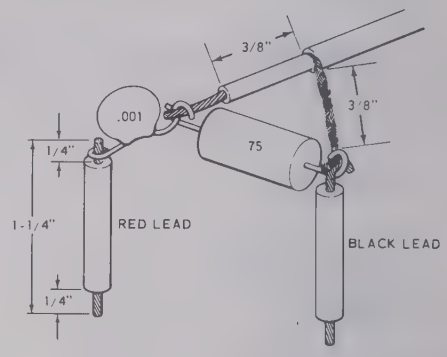
(√) Prepare the free end of one of the remaining coaxial cables as shown in Detail 19A. Apply a small amount of solder to the end of the inner lead and the shield lead.



Detail 19A

(√) Locate a 75 Ω (violet-green-black) resistor and cut off all but 3/8" of each lead. Then form a small loop at the end of each lead.

NOTE: In the following steps, make all connections as close as possible to the body of the resistor and capacitor. This will keep the assembly compact enough to fit into the pod shell.



Detail 19B

Refer to Detail 19B for the following steps.

(√) Connect the inner lead of the coaxial cable to either looped lead of the 75 Ω resistor (NS).

(√) Connect one lead of a .001 μF disc capacitor to the junction of the 75 Ω resistor and inner lead of the coaxial cable (S-3).

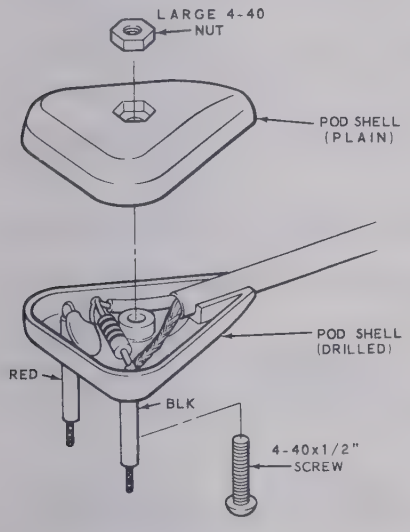
NOTE: When you prepare the short lengths of red and black wire in the next two steps, grip the wire very firmly to prevent pulling the strands out of the insulation.

(✓) Locate the lengths of large red and large black stranded wire and cut off a 1-1/4" length from each wire.

(✓) Hold the short lengths very securely and remove 1/4" of insulation from both ends of each short wire. Apply a small amount of solder to the ends of each wire.

(✓) Wrap the free lead of the .001 μF disc capacitor around one end of the short red wire (S-2). Cut off the excess lead lengths.

(✓) Connect one end of the short black wire to the free end of the 75 Ω resistor (NS).



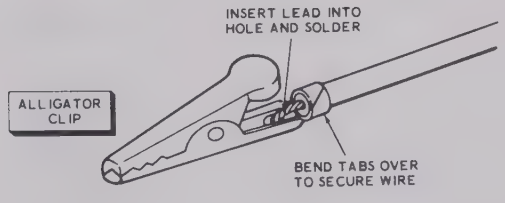
Detail 19C

(✓) Connect the shield lead of the coaxial cable to the junction of the 75 ohm resistor and the short black wire (S-3). Maintain the indicated dimensions as closely as possible. Then cut off the excess lead lengths.

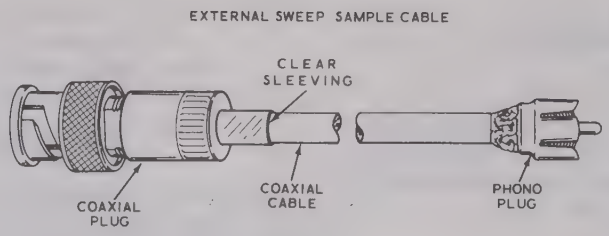
(✓) Refer to Detail 19C and insert the short red and black wires through the holes in the drilled shell (#75-15), and position the assembly in the shell as shown in the Detail.

(✓) Place the plain shell in position and secure the shells together with 4-40 x 1/2" hardware.

(✓) Refer to Detail 19D and solder an alligator clip to the free end of each wire protruding from the pod.



Detail 19D

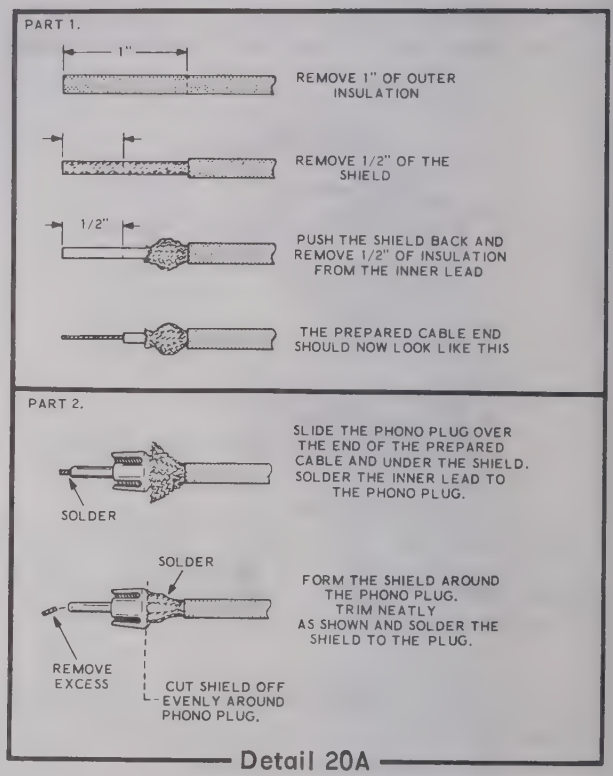


PICTORIAL 20

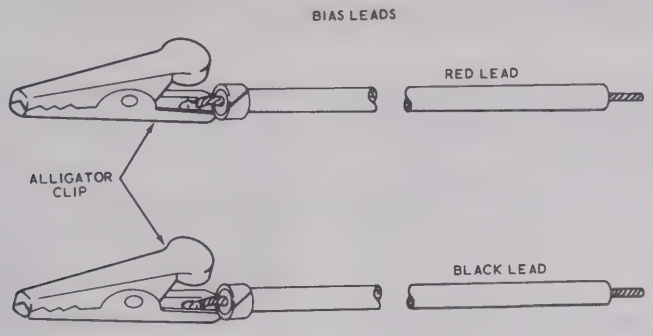
Refer to Pictorial 20 for the following steps.

(√) Prepare the free end of the remaining coaxial cable as shown in Part 1 of Detail 20A.

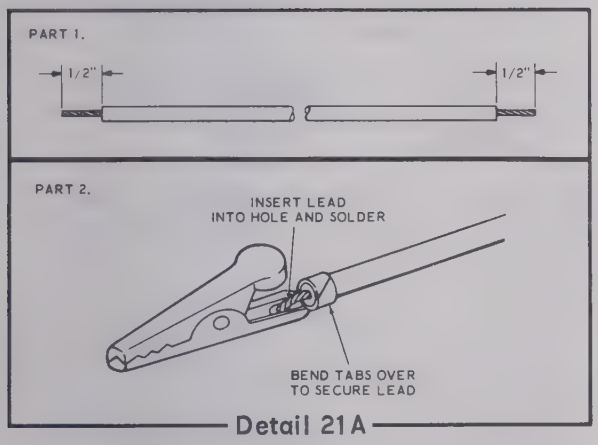
(√) Refer to Part 2 of Detail 20A and install a phono plug on the prepared end of the coaxial cable. Apply only enough heat to cause the solder to flow smoothly.


PART 1.
1"
REMOVE 1" OF OUTER INSULATION
REMOVE 1/2" OF THE SHIELD
1/2"
PUSH THE SHIELD BACK AND REMOVE 1/2" OF INSULATION FROM THE INNER LEAD
THE PREPARED CABLE END SHOULD NOW LOOK LIKE THIS
PART 2.
SOLDER
SLIDE THE PHONO PLUG OVER THE END OF THE PREPARED CABLE AND UNDER THE SHIELD. SOLDER THE INNER LEAD TO THE PHONO PLUG.
SOLDER
FORM THE SHIELD AROUND THE PHONO PLUG. TRIM NEATLY AS SHOWN AND SOLDER THE SHIELD TO THE PLUG.
REMOVE EXCESS
CUT SHIELD OFF EVENLY AROUND PHONO PLUG.

Detail 20A



PICTORIAL 21



Detail 21A

Refer to Pictorial 21 for the following steps.

(✓) Remove 1/2" of insulation from each end of the large black and large red stranded wire as shown in Part 1 of Detail 21A.

(✓) Refer to Part 2 of Detail 21A and solder an alligator clip on one end of each wire. Allow the solder to cool; then bend the tabs over to secure the wire.

(✓) Twist together the small strands on the free end of each wire. Then apply solder to these ends of the two wires.

Place the cables and wires aside. They will be used later.

This completes the basic assembly of your Heathkit TV Post Marker Generator. Carefully inspect all connections for loose wire or unsoldered joints. Remove any wire clippings or solder splashes that may be lodged in the wiring. Be sure no solder bridges exist between the foils of the circuit boards. Route wires so that no ungrounded bare wire touches the chassis or other part or connection. The cabinet shells, handles, end caps, and the feet will be attached in the Final Assembly section.

TESTS AND ADJUSTMENTS

Before you perform the Tests And Adjustments, carefully study the operation of each control and switch as described in Figure 1.

EQUIPMENT REQUIRED

1. Voltmeter: Use a high input impedance electronic voltmeter such as the Heathkit Models IM-11, IM-13, and V-7A VTVM's; or the Heathkit Model IM-16, IM-17, or IM-25 Electronic VOM's.

2. Oscilloscope: Use a general purpose oscilloscope such as the Heathkit Model IO-12, IO-14, or IO-21.

3. Sweep generator: Use a generator which has frequency coverage for FM and TV front end alignment and IF alignment, such as the Heathkit TV Alignment Generators Model TS-4, TS-4A, and IG-52. NOTE: These generators must be modified according to the instructions on Page 38 of this Manual.

4. AM receiver.

INITIAL TEST

Refer to Figure 2 (fold-out from Page 37) for the adjustment locations and test point locations. If you do not obtain the proper results in any of the following tests, or if a malfunction occurs, refer to the In Case Of Difficulty section on Page 52.

( ) Set the controls and switches as follows:

BIAS control	Pushed in and fully counterclockwise.
MARKER control	Fully counterclockwise.
TRACE control	Fully counterclockwise.
RF control	Fully counterclockwise.
MOD switch	Off.
ROCKER switches	Off.

( ) Plug the female end of the line cord into the rear panel AC connector.

( ) Plug the male end of the line cord into a 120 VAC source.

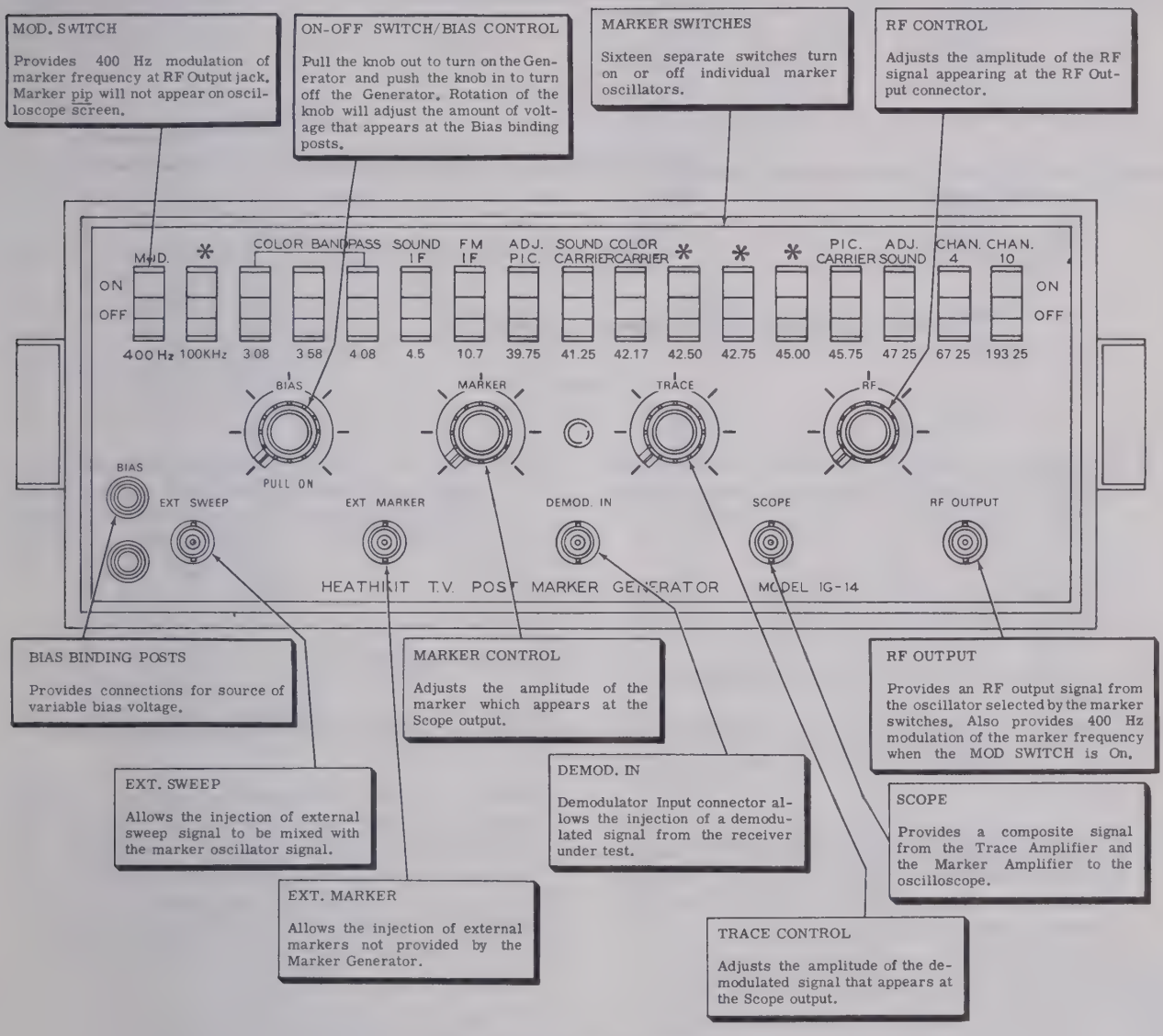
( ) Pull out the BIAS control to energize the Marker Generator. The red pilot lamp should glow.

( ) Connect a voltmeter from TP1 to ground. The voltage at this point should be 13.6 volts DC ±10%.

( ) Remove the voltmeter leads from TP1 and ground and connect them to the BIAS binding posts [positive (+) test lead to red binding post and negative (-) test lead to black binding post]. The voltage at this point, with the Bias control fully counterclockwise, should be zero volts.

( ) Gradually turn the BIAS control to its maximum clockwise position. The voltage should rise from zero to approximately 18 volts DC. ≈ 16.

( ) Remove the voltmeter leads from the BIAS binding posts.


MOD. SWITCH
Provides 400 Hz modulation of marker frequency at RF Output jack. Marker pip will not appear on oscilloscope screen.
ON-OFF SWITCH/BIAS CONTROL
Pull the knob out to turn on the Generator and push the knob in to turn off the Generator. Rotation of the knob will adjust the amount of voltage that appears at the Bias binding posts.
MARKER SWITCHES
Sixteen separate switches turn on or off individual marker oscillators.
RF CONTROL
Adjusts the amplitude of the RF signal appearing at the RF Output connector.
MOD.
COLOR BANDPASS
SOUND IF
FM IF
ADJ. PIC.
SOUND CARRIER
COLOR CARRIER
PIC. CARRIER
ADJ. SOUND
CHAN. 4
CHAN. 10
ON
OFF
400 Hz
100KHz
3.08
3.58
4.08
4.5
10.7
39.75
41.25
42.17
42.50
42.75
45.00
45.75
47.25
67.25
193.25
BIAS
MARKER
TRACE
RF
PULL ON
BIAS
EXT. SWEEP
EXT. MARKER
DEMOD. IN
SCOPE
RF OUTPUT
HEATHKIT T.V. POST MARKER GENERATOR
MODEL IG-14
BIAS BINDING POSTS
Provides connections for source of variable bias voltage.
MARKER CONTROL
Adjusts the amplitude of the marker which appears at the Scope output.
RF OUTPUT
Provides an RF output signal from the oscillator selected by the marker switches. Also provides 400 Hz modulation of the marker frequency when the MOD SWITCH is On.
EXT. SWEEP
Allows the injection of external sweep signal to be mixed with the marker oscillator signal.
DEMOD. IN
Demodulator Input connector allows the injection of a demodulated signal from the receiver under test.
SCOPE
Provides a composite signal from the Trace Amplifier and the Marker Amplifier to the oscilloscope.
EXT. MARKER
Allows the injection of external markers not provided by the Marker Generator.
TRACE CONTROL
Adjusts the amplitude of the demodulated signal that appears at the Scope output.

CONTROL FUNCTIONS

Figure 1

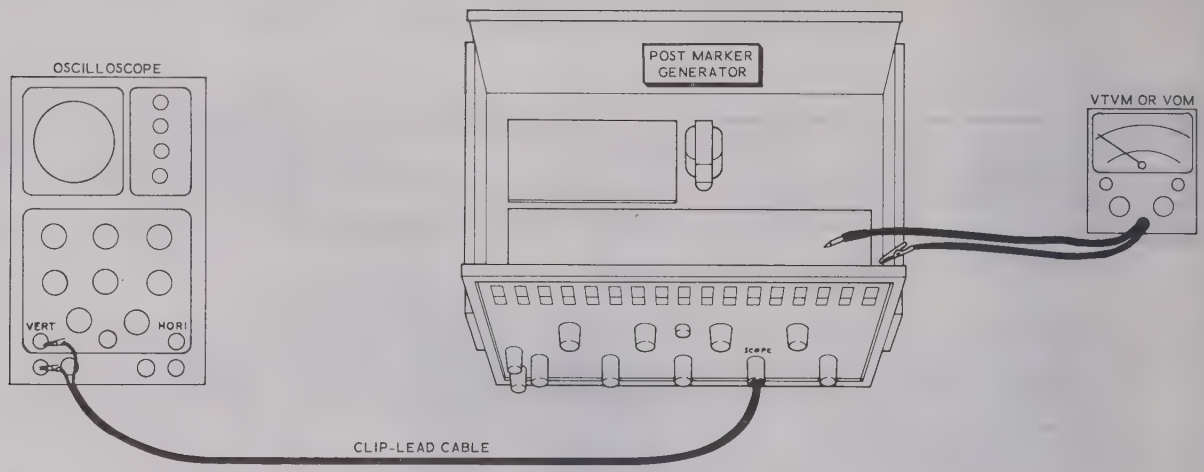


Figure 3

(✓) Connect a coaxial clip-lead cable from the SCOPE jack on the front panel to the vertical input terminals on an oscilloscope (see Figure 3).

(✓) Set the gain control on the oscilloscope to its most sensitive position.

(✓) Set the sweep rate on the oscilloscope to 60 Hz.

(✓) Set the TRACE control to its 12 o'clock position.

(✓) Insert a piece of bare wire into the center of the DEMOD IN jack and touch the wire with your finger. The trace on the oscilloscope should deflect.

(✓) Turn the TRACE control clockwise and counterclockwise. The trace on the oscilloscope should vary in amplitude as the Trace control is turned. Now remove the bare wire.

ADJUSTMENTS

Refer to Figure 2 (fold-out from Page 37) for the following steps.

NOTE: Set the voltmeter range and polarity switches so the meter will read -1.5 volts DC. Connect the voltmeter negative (-) lead to TP1. The negative lead will remain connected to TP1 for all of the following oscillator coil adjustments.

OSCILLATOR COIL ADJUSTMENT CHART

	MARKER SWITCH ON	VOLTMETER POSITIVE LEAD TO:	SLOWLY ADJUST EACH COIL SLUG FOR A MAXIMUM VOLTAGE READING. THEN TURN THE SLUG COUNTERCLOCKWISE 1/8 TURN.	IMPORTANT NOTE
(√)	67.25 MHz	TP2	L1	DISCONNECT
(√)	193.25 MHz	TP3	L2	POSITIVE (+)
(√)	45.75 MHz	TP4	L3	LEAD OF
(√)	47.25 MHz	TP5	L4	VOLTMETER
(√)	42.75 MHz	TP6	L5	THEN TURN
(√)	45.00 MHz	TP7	L6	OFF MARKER
(√)	42.17 MHz	TP8	L7	SWITCH AND
(√)	42.50 MHz	TP9	L8	PERFORM
(√)	39.75 MHz	TP10	L9	NEXT STEP
(√)	41.25 MHz	TP11	L10	IN CHART

( ) Disconnect the voltmeter leads from the Marker Generator.

NOTE: The 3.08, 3.58, 4.08, 4.5, and 10.7 MHz oscillators do not require aligning. Their operation will be checked later.

(√) Turn on an AM receiver and tune it to a station that is a multiple of 100 kHz (700 kHz, 900 kHz, 1200 kHz, etc.), or to station WWV.

(√) Connect the Terminated RF Output cable, with the pod assembly, to the RF OUTPUT jack. Place the pod near the receiver antenna.

(√) Position the RF control fully clockwise, and set the 100 kHz Marker switch to its On position.

(√) Adjust coil L11 for a zero beat in the AM radio. The tone in the AM radio should decrease and increase as the coil is adjusted. A zero beat should occur at the point where the tone from the AM radio is the lowest or no tone can be heard.

(√) Set the 100 kHz Marker switch to Off, and disconnect the RF Output cable from the AM radio antenna.

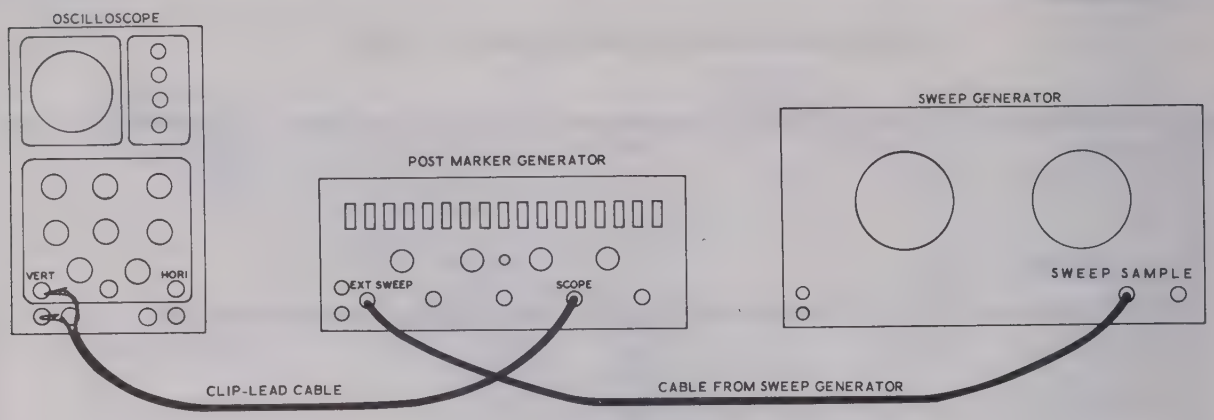


Figure 4

( ) Refer to Figure 4 and connect a cable from the RF SWEEP SAMPLE output on a modified sweep generator to the EXT SWEEP jack on the Marker Generator.

NOTE: The sweep frequency of some sweep generators may not be low enough to cover the color bandpass of a color TV receiver. The sweep frequency of most sweep generators can be lowered by adding a capacitor across the low frequency band oscillator coil in the sweep generator. Figure 5 shows the sweep generator circuit of the Heathkit Model IG-52 TV Alignment Generator. Add a 20 to 50 pF capacitor across the low frequency oscillator coil as shown. This capacitor is not supplied with this kit.

( ) Set the sweep generator to provide a sweep signal from 2.5 to 5 MHz.

( ) Set the 3.08, 3.58, 4.08, and 4.5 MHz marker switches to their On positions. The oscilloscope trace should display the markers in the same order as they are listed on the front panel. The 3.08 marker should appear on the left end of the trace and the 4.5 MHz marker

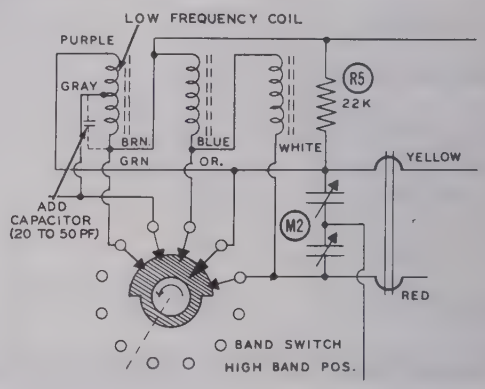


Figure 5

on the right end of the trace. If you are using the internal line sweep position on your oscilloscope and the numbers are reversed, simply reverse the AC line cord plug of your oscilloscope at the AC outlet. This will make the markers appear at the proper ends of the trace.

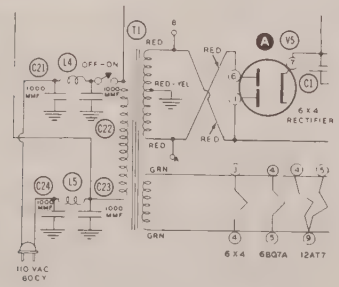


Figure 6

NOTE: If you are using the horizontal input on your oscilloscope and the horizontal output from either the Heathkit Model IG-52, TS-4, or TS-4A alignment generators and the sweep is reversed, switch the two red power transformer secondary leads connected to tube socket "A" as shown in Figure 6. NOTE: This change will also apply to many other sweep generators.

( ) Set the 3.08, 3.58, 4.08, and 4.5 MHz Marker switches to Off. Set the sweep generator to 10.7 MHz with a sweep width of 500 kHz.

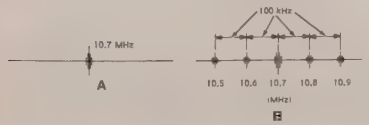


Figure 7

( ) Set the 10.7 MHz marker switch to On. Refer to Figure 7A and note the position and amplitude of the 10.7 MHz marker.

( ) Now set the 100 kHz marker switch to On. Additional smaller markers should appear on the trace every 100 kHz above and below the 10.7 MHz marker (10.5, 10.6, 10.8, 10.9 MHz etc.) as shown in Figure 7B.

( ) Set the 100 kHz and 10.7 MHz Marker switches to Off.

( ) Set the sweep generator to sweep from 39 to 48 MHz.

( ) Set the 47.25 MHz Marker switch to On and adjust the oscilloscope vertical gain control and the Marker Generator MARKER control to produce a waveform of 1/2" amplitude on the oscilloscope. NOTE: Do not change these control settings while you perform the next two steps.

( ) Set the 39.75 Marker switch to On. Adjust L9 for the same marker amplitude as displayed for the 47.25 MHz marker.

Figure 8

Set each of the following Marker switches to their On positions and adjust the proper coil until each marker has the same amplitude as the 39.75 and 47.25 MHz markers. See Figure 8.

Marker Frequency	Adjust Coil
( ) 41.25	L10
( ) 42.17	L7
( ) 42.50	L8
( ) 42.75	L5
( ) 45.00	L6
( ) 45.75	L3

This completes the Tests And Adjustments.

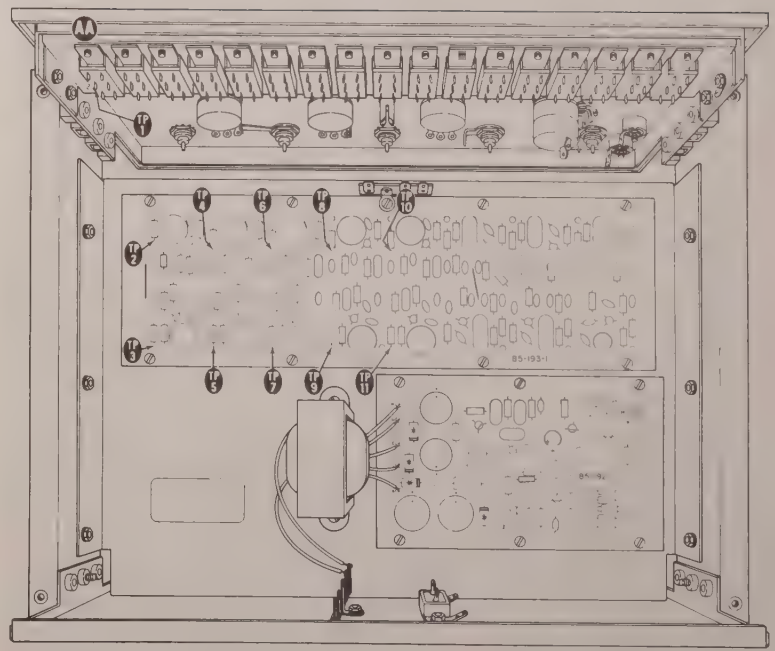
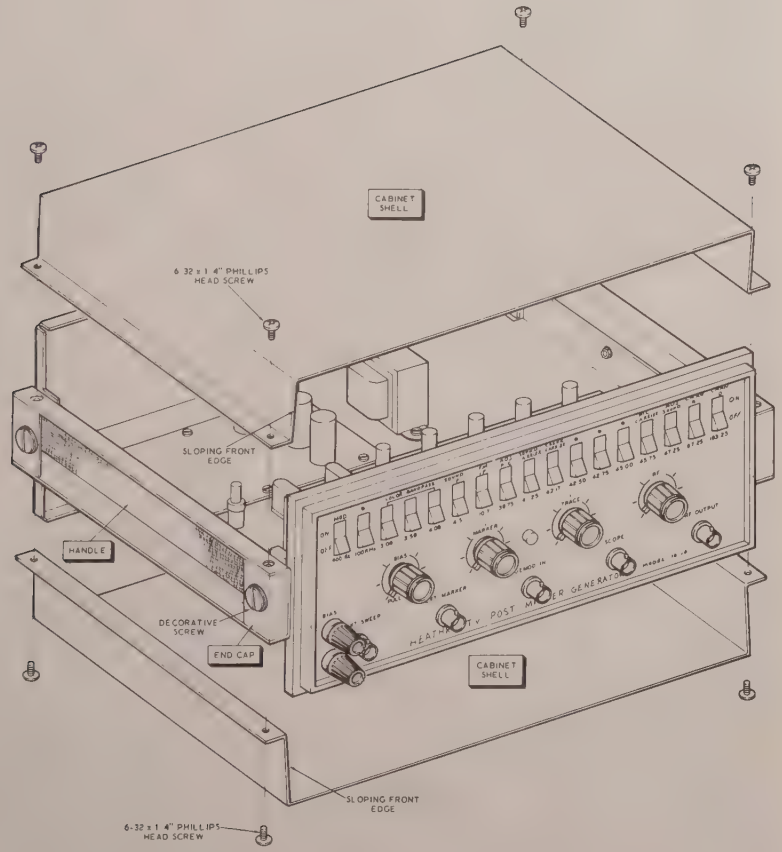


FIGURE 2



PICTORIAL 22

SWEEP GENERATOR MODIFICATION

The Post Marker Generator requires an input sweep signal of a constant amplitude. The input sweep signal should be between .04 and .05 volts at all frequencies. Less voltage produces an insufficient sweep signal, which in turn produces an insufficient marker amplitude. Too much voltage may make it impossible to turn the markers completely off. Therefore the sweep sample should be taken off ahead of the attenuator control where the voltage level is constant.

The following modification pertains mainly to Heathkit Alignment Generators, Model TS-4, TS-4A, and IG-52. Figure 9 is a schematic for the modification of the attenuation circuit. The same information is also applicable for modifying other makes of sweep generators. Refer to the schematic diagram for your particular generator. Some generators use a shielded attenuator, and the sweep signal may have to be brought out of the shielded section. This is done by drilling a hole in the shield and using a short piece of coaxial cable. The coaxial cable should be grounded at both ends.

Perform the following steps.

( ) Remove the sweep generator from its case.

( ) Locate the RF output attenuator control and the RF output jack.

( ) Drill a 1/4" hole close to the RF output attenuator control. Try to drill the hole on the same horizontal plane as the surrounding controls and jacks.

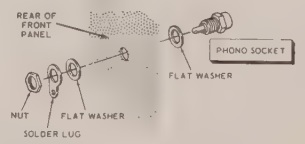


Figure 10

( ) Refer to Figure 10 and mount a phono socket as shown.

( ) Refer to the schematic diagram for your unit to find where the lug for the high side of the attenuator control is located.

( ) Connect a 1000 Ω (brown-black-red) resistor from the high side lug of the attenuator control (S-1) to the center lug of the phono socket (NS).

( ) Connect a 75 Ω (violet-green-black) resistor from the center lug of the phono socket (S-2) to the ground lug of the phono socket (NS).

( ) Connect a ground wire from the solder lug of the phono socket (S-2) to the ground lug of the RF Output connector (S-1).

This completes the modification of your sweep generator. Inspect the connections you just made to be sure they are soldered properly. Then replace the chassis assembly in its cabinet.

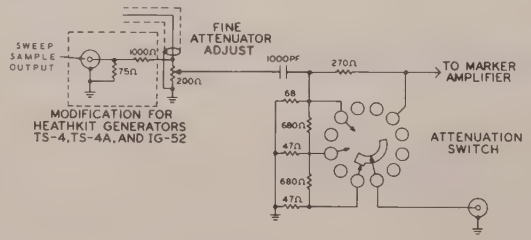


Figure 9

FINAL ASSEMBLY

Refer to Pictorial 22 (fold-out from Page 38) for the following steps.

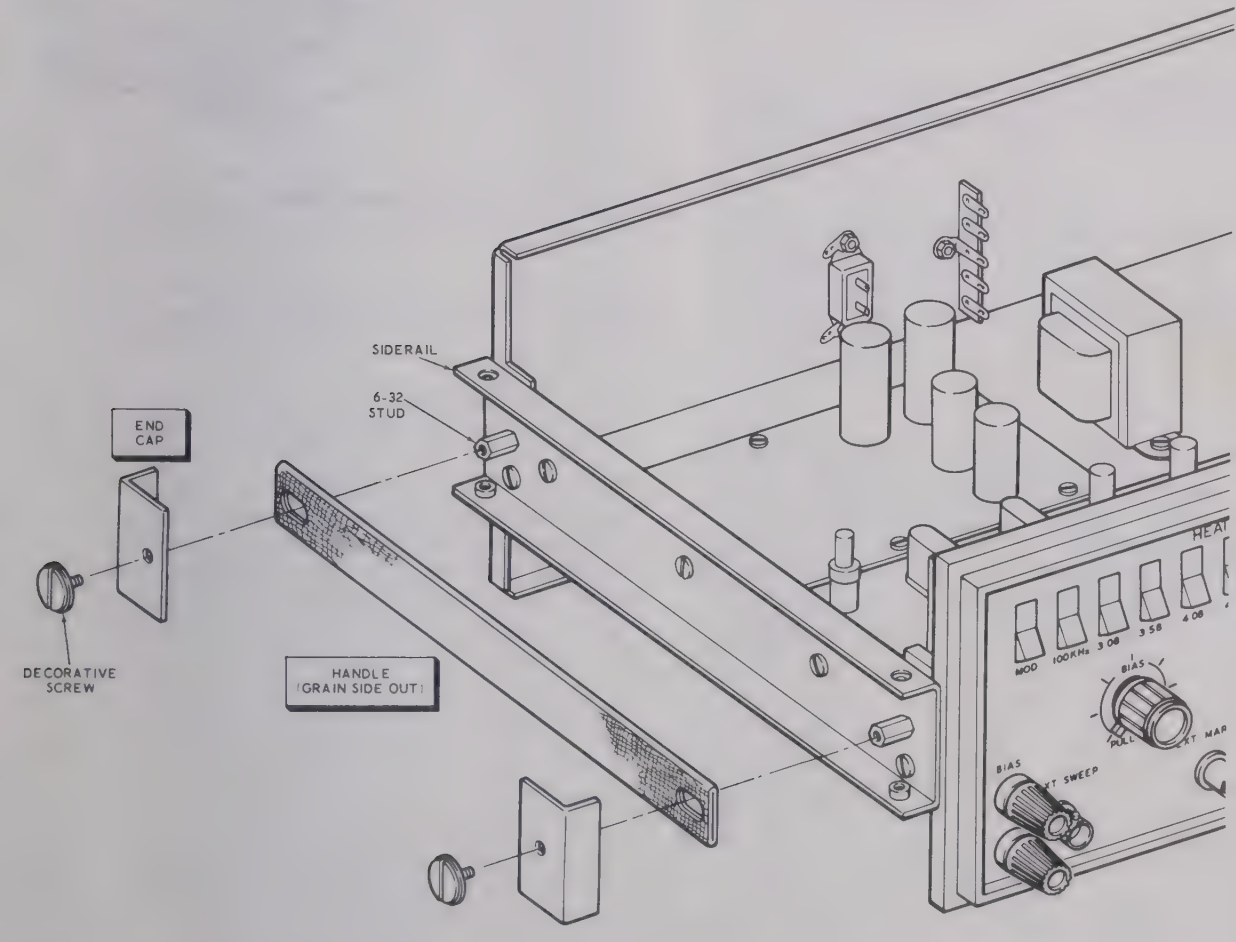
(✓) Remove the tape around each end of both handles.

(✓) Refer to Detail 22A and place one handle, grained side out, over the 6-32 spacer stud as shown. Then place an end cap in position on each end of the siderails and secure each cap with a decorative screw. Use a coin to tighten the screws.

(✓) In the same manner, install the other handle and two end caps on the siderail at the other end of the Marker Generator.

(✓) Place one of the cabinet shells over the top of the Marker Generator chassis with the sloping edge toward the front. Then secure it with 6-32 x 1/4" phillips head screws at the four locations shown.

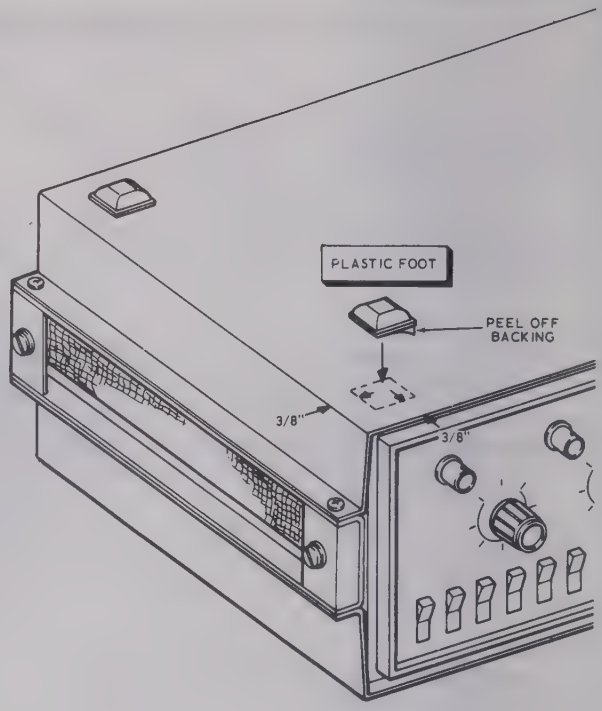
(✓) Turn the Marker Generator over and install the other cabinet shell over the bottom of the chassis. Use 6-32 x 1/4" phillips head screws at the four locations shown.



Detail 22A

( ) Refer to Detail 22B and install a plastic foot near each corner on the bottom cabinet shell. Remove the paper backing; then press the foot onto the cabinet shell in the position shown. A plastic foot can be moved, if necessary, up to one-half hour after the foot was installed. After this time, the adhesive permanently bonds the foot to the cabinet shell.

This completes the assembly of your TV Post Marker Generator.



Detail 22B

APPLICATIONS

This section gives a detailed description of how your Marker Generator can be used to align TV IF, TV trap, VHF tuner, color bandpass, FM tuner, FM IF, and FM tuner tracking. NOTE: Always refer to the manufacturer's instructions when performing the alignment.

PRECAUTIONS

Listed below are several hints and precautions that are useful and necessary when aligning a TV receiver.

1. Disable the high voltage applied to the picture tube. Do this by removing the plate cap from the horizontal output tube. Then connect the load specified by the manufacturer from B+ to ground. This will provide the proper load for the low voltage power supply. Do not allow the disconnected plate cap to contact the chassis.

2. Remove the horizontal oscillator tube to prevent horizontal pulses from appearing on the oscilloscope trace.

3. Remove the vertical oscillator tube to prevent vertical pulses from appearing on the oscilloscope trace.

4. Do not substitute other cables for those supplied with the Marker Generator.

5. Terminate the RF output cable on the sweep generator with its proper impedance, resistor or matching pad. Keep the leads from the terminated cable as short as possible at the point of connection to the receiver under test.

6. Do not dress the sweep generator output leads nor the Demodulation Input cable leads over the IF board, IF coils, and tubes because of possible detuning or oscillation in the section under test.

7. Check and be sure that there are no ground loops between the pieces of equipment. This is easily checked by observing the trace on the oscilloscope and touching each piece of equipment. If the trace moves or changes shape, check all ground connections. It may become necessary to ground all of the cables at one common point.

8. Bias as specified by the set manufacturer should be applied to the receiver under test.

9. More accurate trap adjustments can be obtained by reducing the bias on the IF. Take care not to overload the IF circuits by the application of too much RF signal from the generator.

10. Set the oscilloscope vertical gain control near its most sensitive position and keep the sweep generator output as low as possible. This will prevent overloading the IF amplifiers with a sweep signal which may produce an improper curve and result in misalignment of the IF circuits.

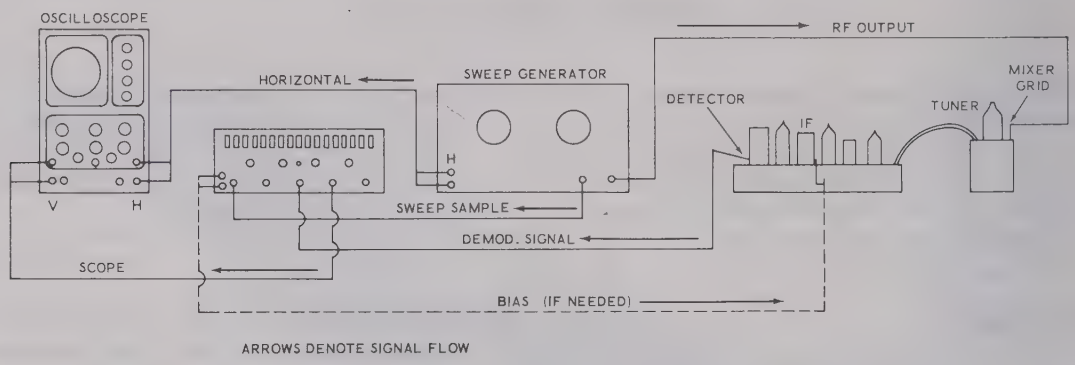


Figure 11

TV IF ALIGNMENT

NOTE: Follow the manufacturers instructions when you align any TV set. Be sure all alignment equipment is at normal operating temperatures.

( ) Refer to Figure 11 and connect the oscilloscope, Post Marker Generator, and sweep generator to the TV set. Be sure all lead connections from the ends of the cables to the TV set are as short as possible (1-3/4" or less). NOTE: If bias voltage is called for, connect the bias leads to the proper point on the TV set. Connect a voltmeter across the BIAS binding posts and adjust the bias voltage as specified by the manufacturer. NOTE: Either positive or negative bias may be applied by reversing the bias leads.

( ) Set the oscilloscope vertical attenuator and vertical gain control to near maximum sensitivity.

( ) Set the sweep generator frequency and sweep width as specified in the alignment instructions. This will usually be about 1 MHz wider than the overall IF bandwidth of the receiver.

( ) Turn on the required marker switches and adjust the MARKER control for the proper marker amplitude. The markers should be just large enough to be seen clearly. The width of the marker will increase slightly as its amplitude is increased.

NOTE: If the IF circuits are far out of adjustment, you may have to inject the signal into the last IF stage, then work toward the IF input. The RF output from the sweep generator will have to be increased when the signal is fed into the last IF stage because there will be very little IF amplification. The RF output must be decreased as the signal input is moved back toward the input of the IF strip. An overall IF check and adjustment should be performed after the stage-by-stage adjustments have been made.

( ) Now perform the alignment procedure as detailed in the manufacturer's alignment instructions.

Figures 12 through 14 show normal and incorrect IF curves. Figure 12A shows a normal IF curve with proper size markers, Figure 12B shows a normal IF curve with excessive marker amplitude. Figure 13 shows an IF curve with horizontal phase, sweep generator, or oscilloscope adjusted incorrectly. Figure 14 shows markers only; Post Marker Generator trace gain at zero.

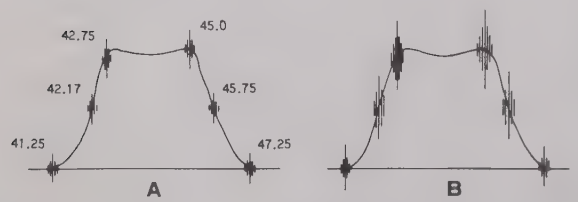


Figure 12

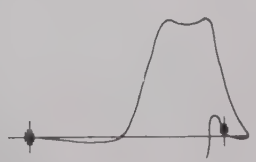


Figure 13

Figure 14

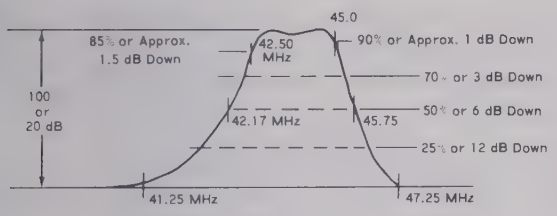


Figure 15

Some set manufacturers specify the position of the marker frequencies as so many "dB down," or as a percentage of full trace size. Figure 15 shows a typical IF response curve with markers indicated both by dB and by percentage. Assume 100% is 20 dB.

To accurately align an IF system or tuner when the manufacturer specifies that the markers should be down "so many dB", you must be able to determine where these points are located on the pattern displayed on your oscilloscope. Not all oscilloscopes produce a linear vertical deflection nor are the vertical attenuators calibrated in dB. You can calibrate your oscilloscope by performing the following procedure. You will need an accurate AC voltmeter and a variable AC voltage source of 0 to 2 volts.

Oscilloscope Calibration

1. Set the vertical gain and the vertical attenuator of the oscilloscope near the maximum gain positions. Do not change the position of these controls during this calibration procedure.

2. Connect the variable AC source to the vertical input of your oscilloscope and adjust the voltage until the trace fills the area between the bottom and top lines on the screen graticule. NOTE: If your oscilloscope does not have a graticule or lines on the screen, use a grease pencil and mark a line on the screen at the top and bottom of the trace. This represents 100% or 20 dB. See Figure 15.

3. Carefully note the reading of the AC meter; then reduce this reading 10%.

4. Use the Vertical Positioning control to position the trace so the bottom of the trace touches the bottom line on the graticule or the mark you made on the screen.

5. Now mark the new position of the top of the trace. This will represent the "1 dB down" point (90% of full trace).

6. Now again reduce the voltage until the reading of the AC voltmeter is 30% lower than the original voltage reading noted in step 3.

7. Use the Vertical Positioning control to again position the bottom of the trace on the bottom line on the graticule or the mark on the screen.

8. Mark the new position of the top of the trace. This will be the "3 dB down" point (70% of full trace).

9. Again reduce the voltage until the reading of the AC voltmeter is 50% lower than the original voltage reading of step 3.

10. Use the Vertical Positioning control to position the bottom of the trace on the bottom line or mark.

11. Mark the new position of the top of the trace. This will be the "6 dB down" point (50% of full trace).

12. Permanently mark these points on the graticule or screen of the oscilloscope. They will be the 90% (1 dB down) 70% (3 dB down) and 50% (6 dB down) points of the trace.

NOTE: If it is necessary to change the operating position of the oscilloscope vertical attenuator during alignment, you should recheck the 1, 3, and 6 dB marks to be sure they are at the proper point for the different setting of the vertical attenuator.

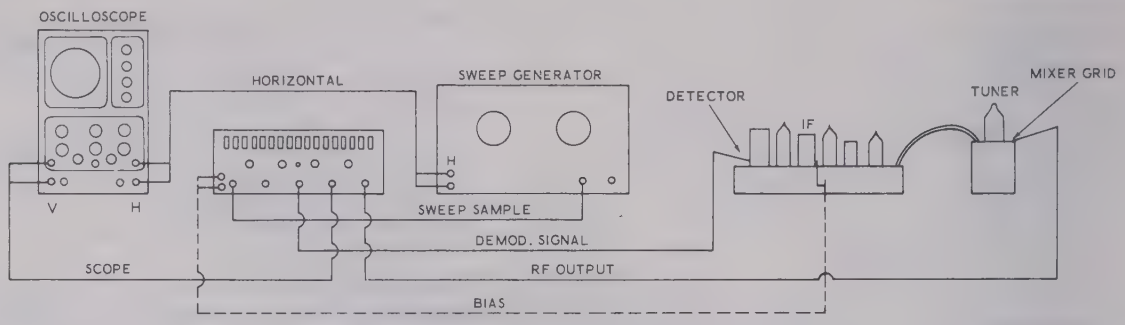


Figure 16

TV TRAP ALIGNMENT

Television trap alignment includes the adjustment of the sound trap and adjacent channel traps for separation of the video and sound signals. Figure 16 shows an equipment set-up for the Post Marker Generator, oscilloscope, and sweep generator connections to the IF strip and tuner of the TV set for the alignment procedure. Adjust the sound and adjacent channel trap to the frequencies specified by the manufacturer for the TV set being aligned. When adjusting the traps, the IF circuits should operate near maximum gain. The modulated RF output from the Post Marker Generator should be kept as low as possible and still produce an adequate pattern on the oscilloscope screen.

( ) Set the 41.25 MHz Marker switch and the MOD switch to On.

( ) Adjust the sound trap for a minimum amplitude of the oscilloscope pattern. If necessary, reduce the IF bias to increase the IF gain. NOTE: As the IF gain is increased the trap adjustment becomes more critical.

( ) Again adjust the sound trap for a minimum amplitude of the oscilloscope pattern.

( ) Repeat the preceding three steps until the sound trap is properly aligned; then turn off the 41.25 MHz Marker switch.

( ) Set the 47.25 MHz Marker switch to On, then follow the same procedure to properly align the adjacent channel sound trap.

NOTE: If the TV set has a 39.75 MHz adjacent picture trap, align it according to the manufacturer's instructions.

( ) Recheck the overall IF alignment for proper marker placement and bandwidth.

NOTE: If you align the IF circuits of a black and white TV set to the same bandwidth as the IF circuits of a color TV set, the picture will be distorted due to the greater bandwidth and the lack of sufficient trapping of the 4.5 MHz sound signals.

TV COLOR BAND PASS ALIGNMENT

NOTE: Figure 17A shows a representative curve for the output stage of a color bandpass circuit. Figure 17B is the overall response curve for the color bandpass amplifier section, with the 3.08 MHz marker down on the slope, the 4.08 MHz marker near the top of the slope, and the 3.58 MHz marker down the slope midway between the other two markers. The 4.5 MHz marker is down in the notch. If the output waveform was made flat, the 3.08 and 3.58 MHz (color carrier) would move up the slope and the lower color-frequencies would be emphasized and result in color smear.

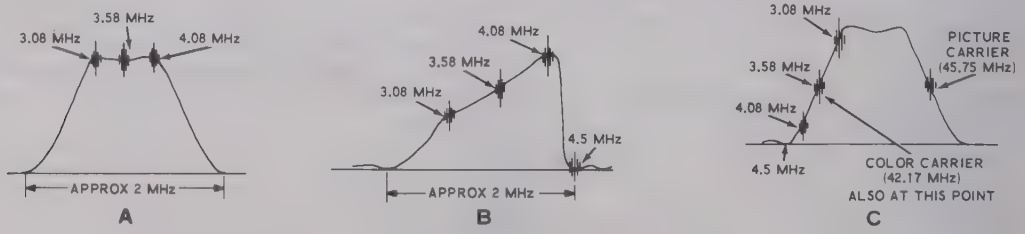


Figure 17

Figure 17C shows the proper relationship between the picture carrier, color carrier and the color bandpass markers as they would appear on an overall IF curve.

Perform the following steps to align the color bandpass coils to allow only the desired frequencies to pass through the circuit.

( ) Connect the Marker Generator, Oscilloscope, and sweep generator to the TV according to the manufacturer's instructions.

( ) Set the sweep generator to sweep from 2 to 5 MHz with a center frequency of 3.58 MHz.

( ) Place the markers on the response curve by setting the 3.08, 3.58, and 4.08 MHz Marker switches to On.

( ) Adjust the color bandpass coils for the response curve shown in the manufacturers instructions. Figure 18 is a typical response curve.

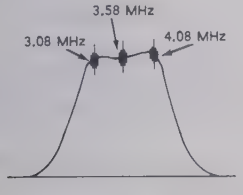


Figure 18

NOTE: It may be necessary to disable the TV set 3.58 MHz color oscillator to prevent mixing the 3.58 Marker signal with the 3.58 oscillator signal. Or the 3.58 Marker switch can be set to Off and the 3.58 oscillator signal in the color TV can be used as a marker.

CHECKING OVERALL VHF TUNER AND IF ALIGNMENT

Check the bandwidth of the TV VHF tuner by performing the following procedure.

( ) Remove the antenna connections at the tuner.

( ) Connect the sweep generator to the VHF tuner antenna terminals according to the manufacturer's instructions.

( ) Connect a coaxial clip-lead cable to the DEMOD IN connector on the POST Marker Generator.

( ) At the other end of the clip lead, connect the inner lead through a 47 kΩ resistor to the TV set detector load. Ground the shield lead to the chassis as close to the detector load as possible.

( ) Turn the channel selector to channel 4.

( ) Set the sweep generator to 67.25 MHz, with a sweep width of 10 MHz.

( ) Set the 67.25 MHz Marker switch to On. This is the channel 4 picture carrier marker.

( ) Set the 4.5 MHz Marker switch to On. A sound carrier marker will appear at 71.75 MHz, which is 4.5 MHz higher in frequency than the picture carrier.

Figure 19

( ) Adjust the VHF tuner per the manufacturer's instructions for the correct response for channel 4 as shown in Figure 19.

( ) See Figure 20 for the correct bandwidth response for channel 10.

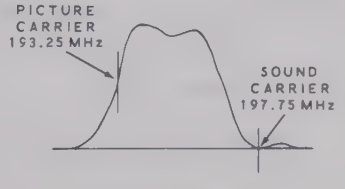


Figure 20

FM RECEIVER, TUNER, AND IF ALIGNMENT

Align the IF coil and the discriminator in the FM tuner according to the following procedure.

( ) Connect the Marker Generator, oscilloscope, and sweep generator to the IF circuit per the manufacturer's instructions.

( ) Set the sweep generator to sweep 10.7 MHz at a sweep width of 500 kHz.

( ) Set the 10.7 MHz and 100 kHz Marker switches to On.

( ) Keep the sweep generator output low enough to prevent limiting.

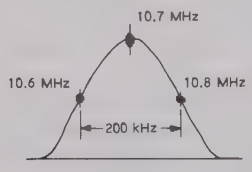


Figure 21

( ) Adjust the IF coil for the correct response as called for in the manufacturer's instructions. Refer to Figure 21 for a typical IF curve.

Align the discriminator using the same markers. Here the sweep generator output should be high enough so that limiting does occur. Refer to Figure 22 for a typical discriminator response curve.

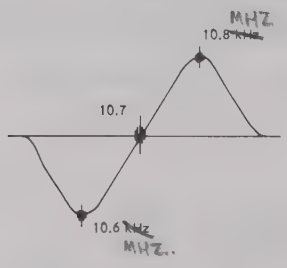


Figure 22

FM TUNER TRACKING

Perform the following steps to check in FM tuner for proper dial tracking.

( ) Connect the RF output cable from the Marker Generator to the antenna terminals of the FM tuner.

( ) Set the 45 MHz Marker and the MOD switch to On.

( ) Adjust the tuner dial until a tone is heard. This should occur at 90 MHz on the FM tuner dial.

( ) Set the 45 MHz Marker switch to Off and the 10.7 MHz Marker switch to On.

( ) Again, adjust the FM tuner dial until a tone is heard. This should occur at 107 MHz on the FM tuner dial. If other marker frequencies are desired, they can be fed through the External Marker jack to the RF output connector.

ALIGNMENT OF THE HEATHKIT TV SETS

NOTE: Refer also to the alignment instructions in the assembly manual for your TV Set.

The following equipment is necessary for this alignment procedure:

1. VHF-TV sweep generator, such as Heathkit TV Alignment Generator, Model IG-52.

2. Heathkit TV Post Marker Generator, Model IG-14.

3. Oscilloscope, such as the Heath Laboratory Oscilloscope, Model IO-14, and an oscilloscope demodulator probe such as the Heath Oscilloscope Demodulator Probe, Model 337-C.

4. Vacuum tube voltmeter, such as the Heathkit Models IM-11, IM-13, and V-7A VTVM; or the Heathkit Model IM-16, IM-17, or IM-25 Electronic VOM.

Video IF Alignment

PREPARATION

( ) Remove the plate cap from the horizontal output tube.

( ) Connect a 2500 Ω 100 watt resistor from the +390 V point to ground.

( ) Set the Normal-Service switch in the Service position.

Refer to Figure 23 (fold-out from Page 51) for the following steps.

( ) Connect a 1 megohm resistor from point G (the IF AGC) to ground at socket V201.

( ) Solder one lead of a 47 kΩ resistor to TP5 (test point 5) on the IF circuit board.

( ) Connect the Post Marker Generator DEMOD IN cable and the VTVM to the free lead of the 47 kΩ resistor. Set the VTVM to the lowest AC range.

( ) Connect the leads of the Post Marker Generator and the sweep generator as shown in Figure 23. Set the oscilloscope vertical attenuator and gain controls to near their maximum gain positions. Turn the oscilloscope horizontal range switch to the external sweep position. NOTE: You can use the oscilloscope "line sweep" if you wish instead of the external sweep.

NOTE: Be sure to terminate the output cable (or cables) of the Sweep Generator in its characteristic impedance. Figure 24 shows how to prepare a matching pad.

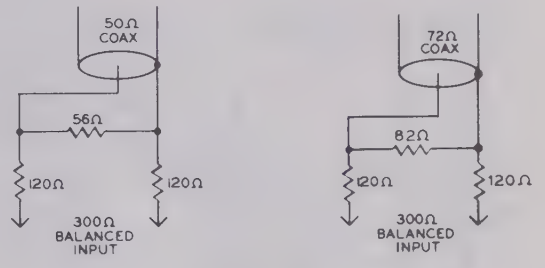


Figure 24

TRAP ALIGNMENT

( ) Connect the free end of the Terminated RF Output cable from the Post Marker Generator to TP1 and ground on the VHF tuner as shown in Figure 23.

TRAP ALIGNMENT CHART

TRAP	POST MARKER GENERATOR	ADJUST FOR MINIMUM
1 Sound trap	41.25 MHz and MOD Switches ON	Top slug of T204, R219.
2. Adjacent channel sound trap	47.25 MHz and MOD Switches ON	L201, R201.

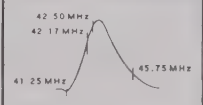
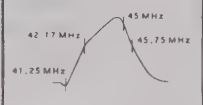
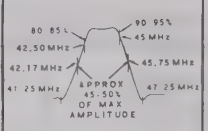
SWEEP ALIGNMENT

Refer to Figure 23 (fold-out from Page 51) for the following steps, and the steps in the Sweep Alignment Chart.

( ) Remove the 1 MΩ resistor between the IF AGC and ground, and connect a jumper wire in its place.

( ) Perform the steps in the following Sweep Alignment Chart.

Sweep Alignment Chart

	STAGE	Connect the sweep and marker generator through a .001 μfd capacitor to test point.*	Sweep generator center frequency approximately 43.5 MHz. Sweep width approximately 8 MHz.	Marker generator Frequency CW (Unmodulated)	Adjust for maximum gain and bandwidth	REMARKS
1	3rd IF T204	TP4 (pin 2 of V203)		42.17 MHz 45.0 MHz 45.75 MHz	T204 (bottom slug)	Adjust output of sweep generator for approximately 2" of deflection. Keep marker output as low as possible and still show markers clearly.
2	2nd IF T203	TP3 (pin 1 of V202)		41.25 MHz 42.17 MHz 42.50 MHz 45.75 MHz	T203	Reduce output of sweep generator.
3	1st IF T202	TP2 (pin 1 of V201)		41.25 MHz 42.17 MHz 45.0 MHz 45.75 MHz	T202	Reduce output of sweep generator.
4	Overall IF response	TP1 (mixer grid)		41.25 MHz 42.17 MHz 42.50 MHz 45.0 MHz 45.75 MHz 47.25 MHz	L112 Mixer plate coil T201 IF input coil	Reduce output of sweep generator. If necessary, retouch preceding IF adjustments to obtain the correct overall response.

*Connect the generator ground lead to the center ground pin of the tube socket.

( ) Disconnect the test leads. Disconnect the 47 kΩ resistor from TP5 and disconnect the jumper wire between point G and socket V201.

Sound Alignment

Refer to Figure 25 for the following steps.

CAUTION: Make sure you adjust only the coils you are directed to adjust in the following steps. Do not adjust any other coils.

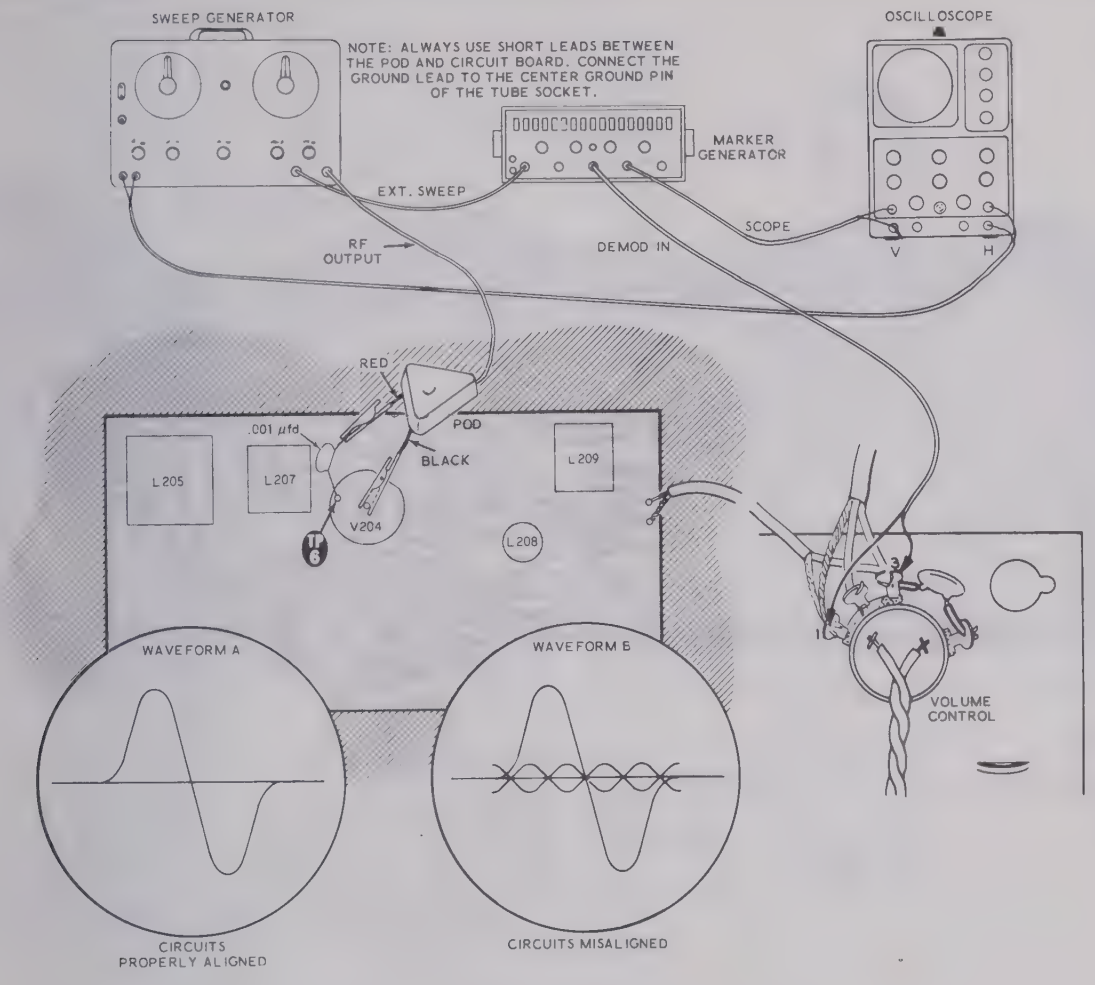


Figure 25

SOUND IF AND DETECTOR ALIGNMENT

( ) Connect the lead of a .001 µF capacitor to TP6.

( ) Connect the pod leads of the Sweep Generator RF Output cable to the free end of the .001 µF capacitor and ground as shown in the Figure.

( ) Set the 4.5 MHz Marker switch to On, and set the Sweep Generator to 4.5 MHz with a sweep width of about 500 kHz.

( ) Connect the inner lead of the DEMOD IN cable to lug 3 and the shield lead to lug 1 (ground) of the Volume control.

NOTE: Keep the output signals from the generators adjusted to a low amplitude during the following steps. This will keep them from overloading the circuits and distorting the waveform.

Adjust the following coils to obtain waveform A as shown in Figure 25. When these coils are tuned properly, a turn in either direction of any coil slug will produce the misaligned pattern of waveform B.

( ) L207 (top and bottom slugs).

( ) L208.

( ) L209.

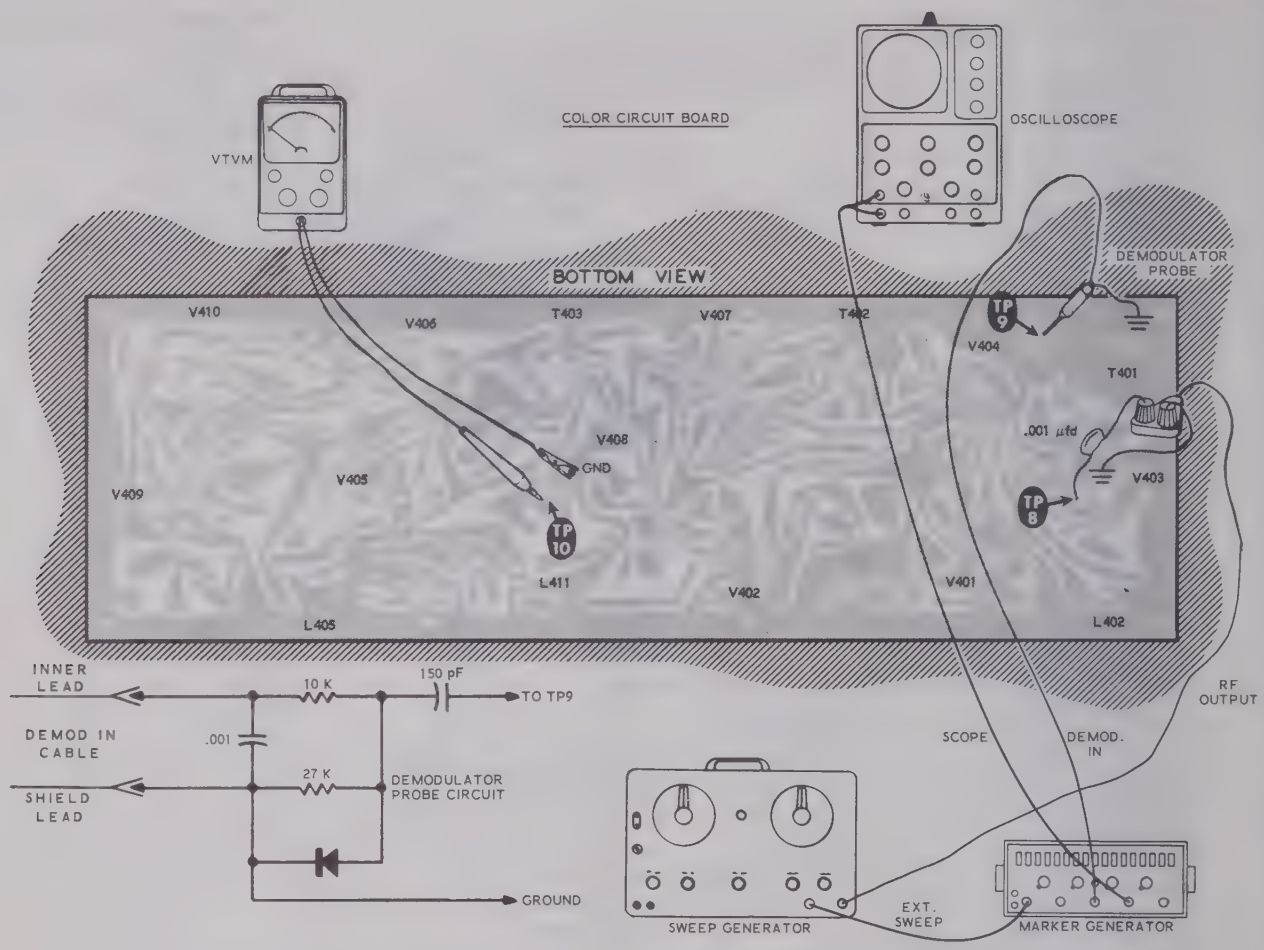


Figure 26

4.5 MHz TRAP ALIGNMENT

( ) Place the TV set Normal-Service switch in the Service position.

( ) Connect the pod leads of the Terminated RF Output cable coming from the Post Marker Generator to ground and TP5. See Figure 23 for the location of TP5.

( ) Set the 4.5 MHz and the MOD switches of the Post Marker Generator to On.

NOTE: Refer to the circuit drawing on Figure 26 and prepare a demodulator probe if you do not already have one.

( ) Connect the DEMOD IN cable through the demodulator probe to TP7. (NOTE: TP7 is the green wire on the Normal-Service switch).

( ) Adjust the 4.5 MHz trap L205 for minimum indication on the oscilloscope.

( ) Return the Normal-Service switch to the Normal position.

Color Alignment (Figure 26)

3.58 MHz TRANSFORMER (T403) ADJUSTMENT

( ) Connect a VTVM, set to read negative DC voltage on the 15 volt range, to TP10.

( ) Adjust T403 for maximum grid voltage.

( ) Disconnect the VTVM.

BANDPASS ALIGNMENT

( ) Remove the horizontal oscillator and third video IF tubes.

( ) Remove the plate cap from the horizontal output tube.

( ) Set the Color control to midrange.

( ) Connect the oscilloscope through a demodulator probe to TP9.

( ) Connect the sweep generator to TP8 through a .001 μF capacitor. Set the sweep generator for a center frequency of 3.58 MHz, with a sweep width of about 2 MHz.

( ) Adjust the top and bottom slugs of T401 for the response curve shown in Figure 27.

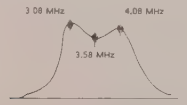


Figure 27

( ) Remove the Sweep Generator lead from TP8 and connect it to TP5 on the IF circuit board (see Figure 23 for the location of TP5). Reduce the output of the generator.

( ) Adjust L402 for the response curve shown in Figure 28. (NOTE: The 3.58 MHz marker from the TV Set 3.58 MHz oscillator will be present on this response curve.)

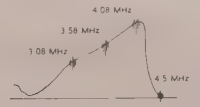


Figure 28

RF Alignment

Refer to Figure 29 for the following steps.

( ) Connect the Post Marker Generator, oscilloscope and sweep generator to the VHF tuner. Set the bias supply to -2.5 volts for the VHF tuner as shown.

( ) Turn the TV Channel Selector to the channel 10 position.

( ) Set the sweep generator to 196 MHz, with a sweep width of 10 MHz.

( ) Set the Post Marker Generator 193.25 MHz (picture carrier) and the 4.5 MHz Marker switches to On. NOTE: The 4.5 MHz signal will beat with the 193.25 MHz picture carrier signal and produce a marker at 197.75 MHz on the trace which will be the sound carrier marker.

( ) Adjust capacitors C113 and C114 for the correct response, as shown.

( ) If the tilt or valley between the markers cannot be adjusted to within the 30% maximum tolerance, it can be brought within limits by physically compressing or expanding coil L107.

( ) Check the other channels for the correct bandwidth, and tilt or valley.

( ) Compress or expand coil L107 to bring the tilt or valley within the 30% tolerance on any channel where the valley is over 30% of the overall waveform amplitude.

NOTE: If the bandwidth is too wide or too narrow on most of the high channels, it can be corrected by compressing or expanding coil L112. If the RF amplifier tube is changed, it may also be necessary to adjust RF neutralizing capacitor, C109 to obtain a bandwidth as shown in Figure 29.

( ) Shut off the TV set and disconnect all of the alignment equipment.

( ) Disconnect the 2500 Ω 100 watt resistor and replace the plate cap on the horizontal output tube.

( ) Replace the horizontal oscillator and the third video IF tubes.

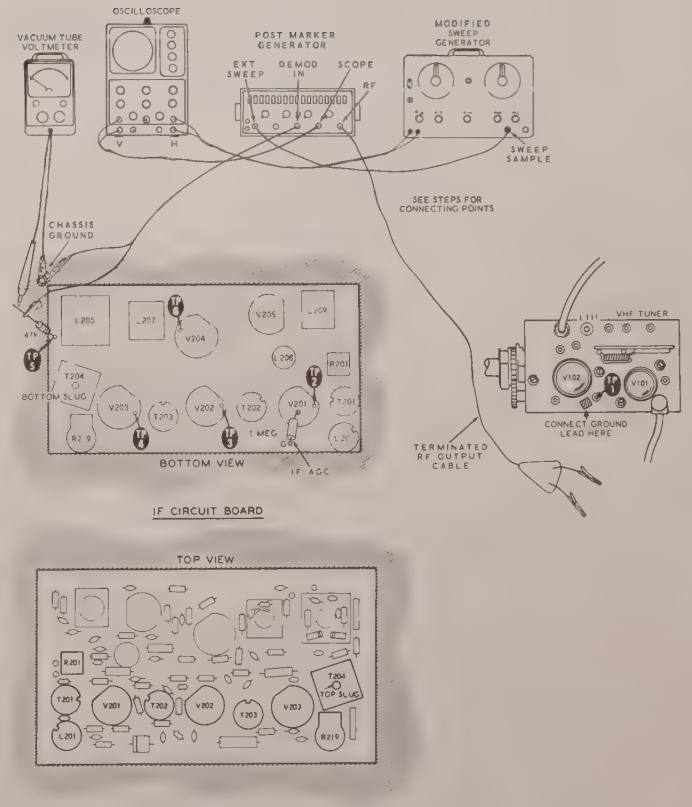


FIGURE 23

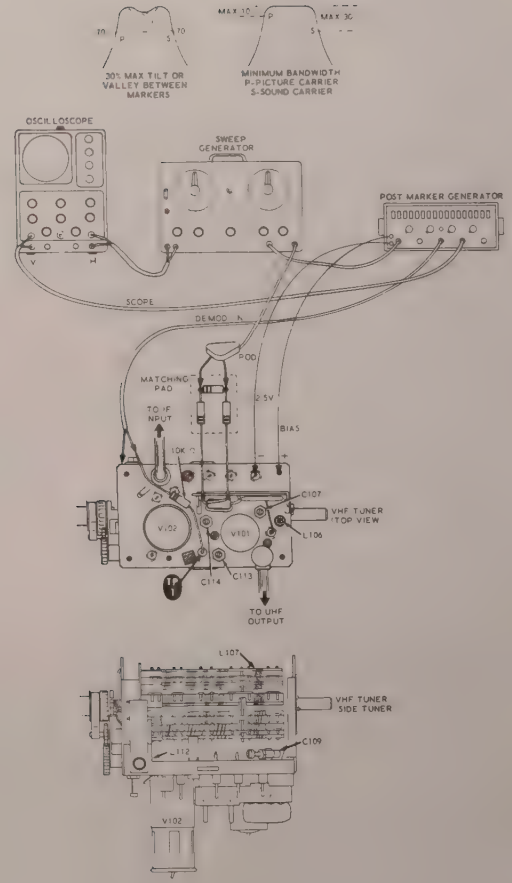
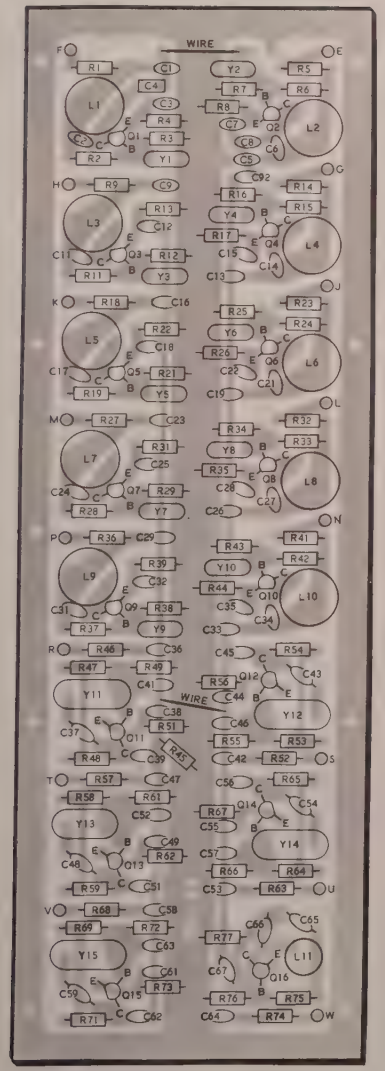
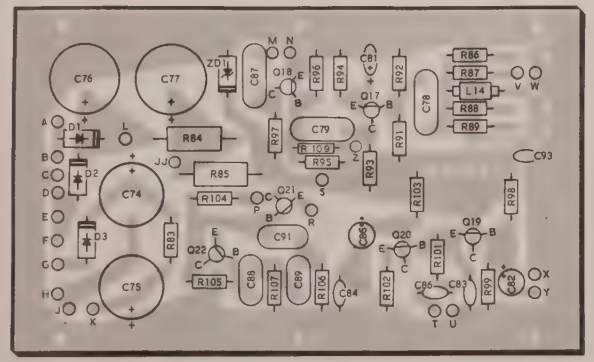


FIGURE 29



CIRCUIT BOARD X-RAY VIEWS
(VIEWED FROM FOIL SIDE)



VHF OSCILLATOR ALIGNMENT

Do not perform the following steps unless the Fine Tuning control will not tune through a station.

( ) Turn on the TV set.

( ) Connect the VHF antenna to the antenna input terminals of the tuner.

( ) Tune through each of the channels normally received in your locality. If the Fine Tuning control does not properly tune all of these channels, set the Channel Selector to the Channel on which the Fine Tuning Control has the least effect (the one that is farthest off frequency).

( ) Turn the Fine Tuning control two full turns clockwise, then turn it back counterclockwise exactly one turn. This will center the Fine Tuning control mechanically for this channel.

This completes the alignment procedures.

IN CASE OF DIFFICULTY

This section of the Manual is divided into three parts: Visual Test, Precautions For Troubleshooting, and the Troubleshooting Chart. Begin your search for any troubles that occur after assembly by carefully following the checks listed in the Visual Test section. After visual tests are completed, refer to Precautions For Troubleshooting and to the Troubleshooting Chart.

Refer to the Service and Warranty sections of the Kit Builders Guide if you are unable to resolve the difficulty. If the Post Marker Generator is returned to Heath Company, be sure all cables are included.

NOTE: Refer to the Circuit Board X-Ray Views (fold-out from this page) and photos (on Page 60) for physical locations of parts on the circuit boards and on the chassis.

VISUAL TESTS

1. About 90% of the kits that are returned for repair, do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by a careful inspection of connections to make sure they are soldered as described in the Proper Soldering section of the Kit Builders Guide. Reheat any doubtful connections and be sure all the wires are soldered at places where several wires are connected.

2. Check to be sure that all transistors are in their proper locations, and are installed correctly.

3. Check the values of the parts. Be sure that the proper part has been wired into the circuit, as shown in the Pictorial diagrams and as called out in the wiring instructions. It would be easy, for example, to install a 2200 Ω (red-red-red) resistor in a step that calls for a 220 Ω (red-red-brown) resistor.

4. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something you have consistently overlooked.

5. Check all wires connected to the circuit boards. Make sure the wires do not extend through the circuit board and make contact with other connections such as component leads.

6. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

NOTE: A review of the Circuit Description may help you determine where a trouble is located.

PRECAUTIONS FOR TROUBLESHOOTING

1. Be cautious when testing transistor circuits. Although transistors have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than tubes. A vacuum tube can often be operated under shorted, zero-bias, excessive-voltage, or high-current conditions for short periods of time without materially damaging the tube. Any one of these same conditions can completely destroy a transistor instantly.
2. Be sure you do not short any terminals to ground when making voltage measurements. If the probe should slip, for example, and short out a bias or voltage supply point, it is almost certain to cause damage to one or more transistors or diodes.
3. Transistors should be inserted or removed only while the Marker Generator is turned off. If this rule is not followed, transistors may be damaged.

Troubleshooting Chart

SYMPTOM	CAUSE	CURE
Pilot lamp does not glow.	1. Generator line cord plug not inserted into AC outlet. 2. Open or incorrect resistor in series with pilot lamp. 3. Incorrect wiring of terminal strip on chassis, or rear panel. 4. Defective line cord, outlet, pilot lamp, or on-off switch.	1. Plug unit into AC outlet. 2. Check wiring of pilot lamp circuit and correct any errors. 3. Check wiring of terminal strip on chassis and rear panel and correct any errors. 4. Replace defective components.
No B+ voltage (+13.6 VDC).	1. Incorrect value of R84 and R85. 2. Shorted zener diode ZD1. 3. Defective diode D1 or D2, power transformer T1, or filter capacitor C76 and C77.	1. Check resistance values and correct any errors. 2. Replace zener diode ZD1. 3. Replace defective components.
High B+ voltage (over 14.9 VDC).	1. Defective zener diode ZD1.	1. Replace defective components.
3.08 to 10.7 MHz oscillator inoperative or low output.	1. Incorrect value of resistor or capacitor within the defective circuit. 2. Defective transistor or crystal within the defective circuit.	1. Check resistance and capacitance values and correct any errors. 2. Replace defective components.

SYMPTOM	CAUSE	CURE
39.75 to 193.25 MHz oscillator inoperative or low.	1. Incorrect value of resistor or capacitor within the defective circuit. 2. Oscillator coil misaligned. 3. Defective transistor or crystal within the defective circuit.	1. Check resistance and capacitance values and correct any errors. 2. Check oscillator coil alignment. 3. Replace defective components.
No bias voltage.	1. Defective diode D3, capacitor C74 or C75, power transistormer T1, resistor R83 or Bias control R82.	1. Replace defective components.
No marker.	1. Insufficient sweep sample. 2. Incorrect value of resistor or capacitor within the marker amplifier circuit. 3. MOD switch is On. 4. Oscillator coil misaligned. 5. Defective Marker control.	1. Increase output of external sweep generator. 2. Check resistance and capacitance values and correct any errors. 3. Turn MOD switch to Off. 4. Check oscillator coil alignment. 5. Replace defective component.
Excessive marker or unable to turn marker completely off with Marker control.	1. Too much sweep sample. 2. Incorrect value of capacitor C86.	1. Decrease output of external sweep generator. 2. Check capacitance value and correct any errors.
No trace.	1. Defective marker or trace amplifier.	1a. Check all wiring around Q20. Also check Q20. 1b. Check for shorted capacitor C84 or other defective components.
Excessive noise (hash) on trace or marker. Noise increases when Marker control is advanced.	1. Defective transistor Q17, Q18, Q19 or Q20.	1. Replace defective transistors.

SPECIFICATIONS

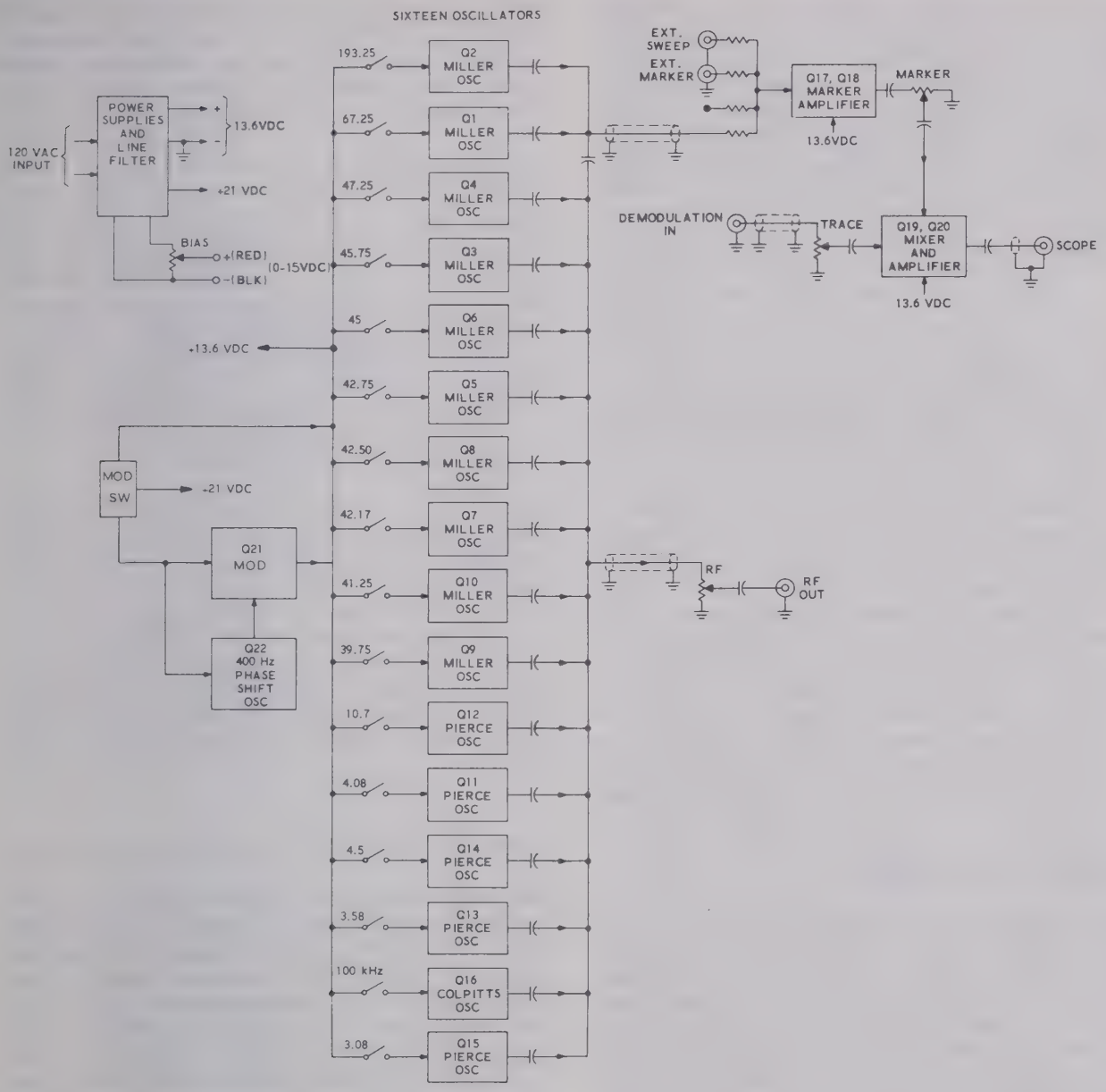
Marker Frequencies	100 kHz. 3.08 MHz, 3.58 MHz, ± .01%. 4.08 MHz, 4.5 MHz, ± .01%. 10.7 MHz, 39.75 MHz, 41.25 MHz, ± .005%. 42.17 MHz, 42.50 MHz, 42.75 MHz, ± .005%. 45.00 MHz, 67.25 MHz, 193.25 MHz, ± .005%.
Modulation	400 Hz.
Input Impedance	EXT Sweep - 75 Ω EXT Marker - 75 Ω. DEMOD IN - 220 kΩ.
Output Impedance	RF Output - 75 Ω. Scope - 22 kΩ.
Output Voltage	Positive or negative 15 volts DC at 10 milliamperes.
Type of Marker	Birdie.
Controls	Bias control with on/off switch. Marker. Trace. RF. Marker switches for each of the above frequencies. MOD switch.
Transistor - Diode Complement	16 - 2N3692 silicon transistors. 6 - 2N3393 silicon transistors. 3 - silicon diodes. 1 - 13.6 volt zener diode.
Power Requirements	120 volts, 60 Hz AC, 7.5 watts.

The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate the new features in instruments previously sold.

CIRCUIT DESCRIPTION

The following description of the Post Marker Generator describes each circuit in detail. Refer to the Block Diagram and to the Schematic (fold-out from Page 61) while reading this section. The Block Diagram illustrates the relationships between the inputs, outputs, controls, and functional circuits in the Marker Generator. Several of the oscillators operate on fundamental crystal frequencies and some operate in the third or fifth overtone mode. The following table lists the sixteen oscillators and identifies each by transistor reference designator, output frequency, crystal frequency, mode of crystal operation, and the type of oscillator circuit.

OSCILLATOR	OUTPUT FREQ	CRYSTAL FREQ	MODE	TYPE OSC CIRCUIT
Q1	67.25 MHz	67.25 MHz	5th overtone	Miller
Q2	193.25 MHz	96.625 MHz	5th overtone	Miller
Q3	45.75 MHz	45.75 MHz	3rd overtone	Miller
Q4	47.25 MHz	47.25 MHz	3rd overtone	Miller
Q5	42.75 MHz	42.75 MHz	3rd overtone	Miller
Q6	45.00 MHz	45.00 MHz	3rd overtone	Miller
Q7	42.17 MHz	42.17 MHz	3rd overtone	Miller
Q8	42.50 MHz	42.50 MHz	3rd overtone	Miller
Q9	39.75 MHz	39.75 MHz	3rd overtone	Miller
Q10	41.25 MHz	41.25 MHz	3rd overtone	Miller
Q11	4.08 MHz	4.08 MHz	fundamental	Pierce
Q12	10.7 MHz	10.7 MHz	fundamental	Pierce
Q13	3.58 MHz	3.58 MHz	fundamental	Pierce
Q14	4.5 MHz	4.5 MHz	fundamental	Pierce
Q15	3.08 MHz	3.08 MHz	fundamental	Pierce
Q16	100 kHz	No crystal	L tuned	Colpitts



BLOCK DIAGRAM

Each of the sixteen oscillators is turned on when the applicable Marker switch applies DC supply voltage (+13.6 volts DC) to the desired oscillator circuit. Since each output frequency is generated by a separate oscillator, any number of frequencies may be selected at the same time by simply closing the desired Marker switches. The outputs of all sixteen oscillators are coupled together through DC blocking capacitors and applied through a common RF buss to the RF output control. The oscillators may be AM modulated by a 400 Hz oscillator which varies the DC supply voltage applied to the oscillators. Turning the Modulator switch On energizes the 400 Hz oscillator, which in turn modulates all oscillators whose marker switches are turned on. With the MOD switch in the On position, the marker is biased to cutoff by resistor R109.

The sixteen oscillator outputs are also applied to the marker amplifier input, where they are mixed with an external sweep signal. The amplifier output is applied across the Marker control, which adjusts the amplitude of the marker signals applied to trace amplifier Q19 and Q20. The marker signals are mixed with the Demodulated Input signal appearing across the Trace control. The mixer and marker amplifier output is applied to the Scope jack. The signals at the Scope jack consist of the markers selected, mixed with any other external sweep and demodulator inputs.

MILLER OSCILLATOR

The Miller oscillators generate all the RF outputs above and including 39.75 MHz. These oscillators operate with third overtone crystals and fifth overtone crystals. They are all identical in operation, but have slightly different values depending upon the frequency of oscillation. The oscillator is basically a tuned-base tuned-collector circuit, with the crystal used as the tuned-base circuit. The tuned-collector circuit is a parallel resonant LC circuit, which is tunable to adjust the output amplitude of the oscillator. In all of the Miller oscillators, except Q2, the collector circuit is tuned to the crystal frequency. The 193.25 MHz output produced by Q2 is the second harmonic of the 96.625 MHz fifth overtone crystal used in the base circuit. The 193.25 MHz output is obtained by tuning the base circuit of Q2 to the second harmonic, operating the stage as a frequency doubler.

The oscillator outputs are capacitively coupled to the common RF output buss from the emitter load resistor on all the Miller oscillators except Q1 and Q2. These two oscillator outputs are coupled from the collector.

PIERCE OSCILLATOR

The Pierce oscillator circuits generate all the frequencies below and including 10.7 MHz, except for the 100 kHz oscillator. These oscillators use crystals operating on their fundamental frequency, and are basically crystal versions of a Colpitts oscillator. The crystal is the feedback element from collector-to-base and operates inductively. The oscillator output is capacitively coupled from the collector to the RF buss. The Pierce oscillators are not tunable.

The Colpitts oscillator (Q16) generates the 100 kHz output. This oscillator is not crystal controlled. A parallel-resonant LC tank circuit in the collector circuit determines the output frequency of the Colpitts oscillator. The collector-to-emitter feedback from the tapped capacitors in the tank circuit maintains the oscillation of the circuit and its output is capacitively coupled from the base to the RF buss. The coil in the tank circuit is adjusted to tune the oscillator to 100 kHz.

MARKER AMPLIFIER

The marker signal is produced by beating the RF signals (CW) with the external sweep signal. When the sweep signal passes through its range, and an RF signal is present in that range, the two frequencies beat together and produce a null or "birdie". The sum and difference frequencies are also produced, but normally fall outside the frequency range being swept. They may appear in some patterns however, depending on sweep generators and frequencies involved.

The marker amplifier consists of two stages (Q17 and Q18) which are operated as conventional grounded-emitter class A amplifiers in cascade, with RC coupling between stages. The input to the first stage, Q17, is normally a composite signal, composed of the RF oscillator outputs selected and a sweep generator signal applied to the input jack. The signals are applied through isolating resistors to an RF coil, where they are mixed

across the common load. The resulting composite signal is then capacitively coupled to the base of Q17 where it is amplified and then coupled to Q18, which further amplifies the signal. The collector output of Q18 is then capacitively coupled to the Marker control, where a portion of the signal appearing across the control is applied to the demodulation mixer and amplifier circuit, Q19 and Q20.

DEMODULATION MIXER AND AMPLIFIER

The input signal to this circuit is supplied by the receiver under test. This demodulated signal is fed through the Demodulation Input jack and appears across the Trace control. A portion of this signal is capacitively coupled to the base of Q19. The mixer and amplifier circuit consists of Q19 and Q20 connected in a compound configuration similar to a Darlington pair. The Darlington configuration results in a high input impedance. The circuit functions as a compound emitter follower, with an output current approximately equal to the sum of the currents in the individual transistors.

The marker and sweep signal is injected at the base of Q20, where it is mixed with the demodulated input signal. The amplifier output is capacitively coupled from the collector of Q20 to the Scope jack for viewing with an oscilloscope.

MODULATOR CIRCUIT

The modulator circuit consists of Modulation switch S18, oscillator Q22 and modulator Q21. With the Modulation switch in the On position, a DC voltage is applied through resistor R110 and through Modulation switch S18 to the Collector of Q21. Resistor R104 is the collector load of modulator Q21. The frequency of oscillation of 400 Hz oscillator Q22 is determined by the values of R and C in the collector-to-base circuit. These values are proportioned so the total phase shift from collector output to base input to base input is 180 degrees resulting in a modulating frequency of 400 Hz.

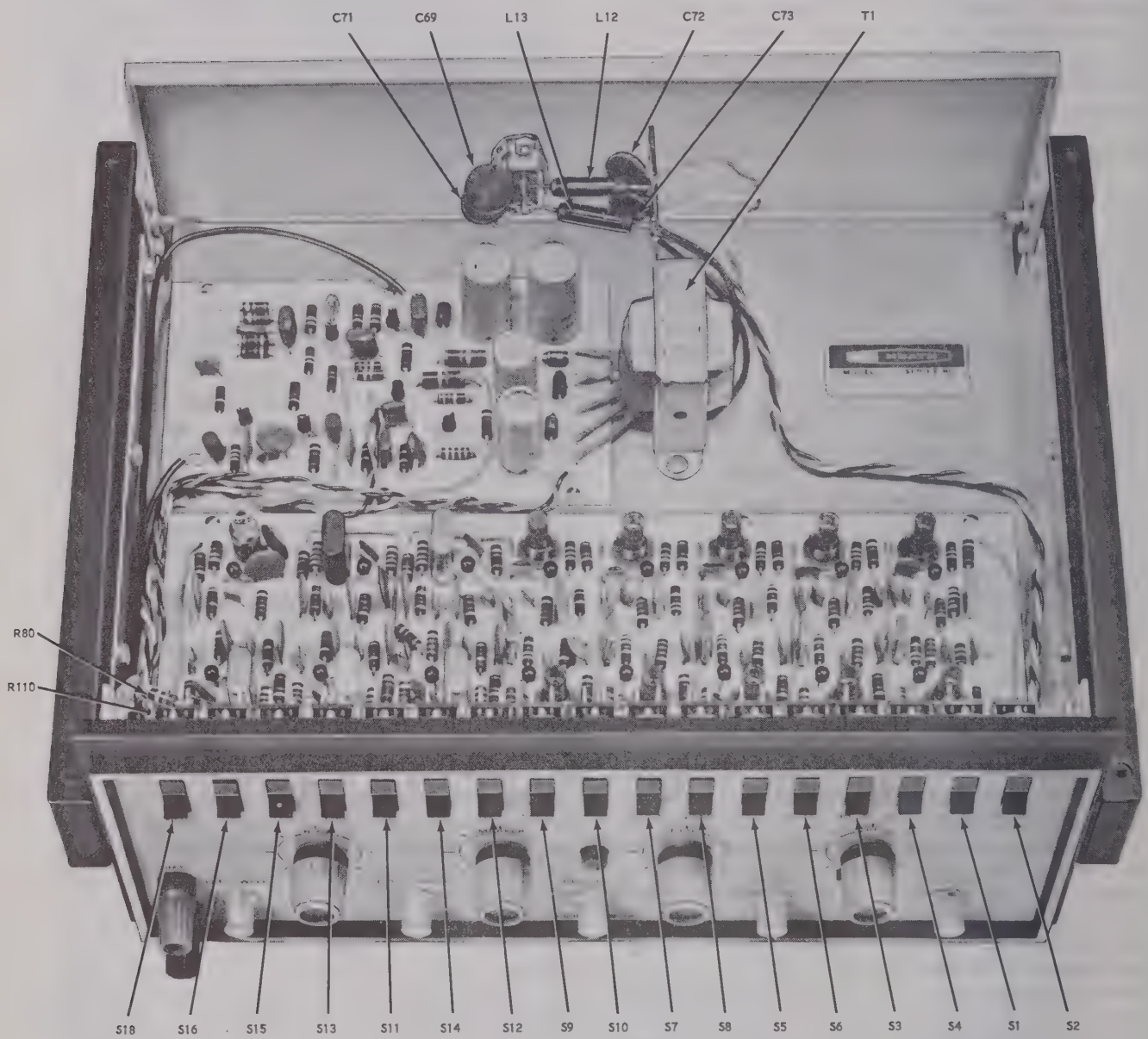
The 400 Hz signal at the collector of Q22 is applied to the base of modulator Q21. This stage is basically an emitter follower using the sixteen Marker oscillators as its emitter load. The 400 Hz signal at the base of Q21 effectively varies the emitter-to-collector impedance at a 400 Hz rate. Since this varying impedance is in series with the DC voltage applied to the marker oscillators, the DC voltage will vary at a corresponding rate. Therefore, the RF output of the marker oscillators will vary in amplitude at a 400 Hz rate.

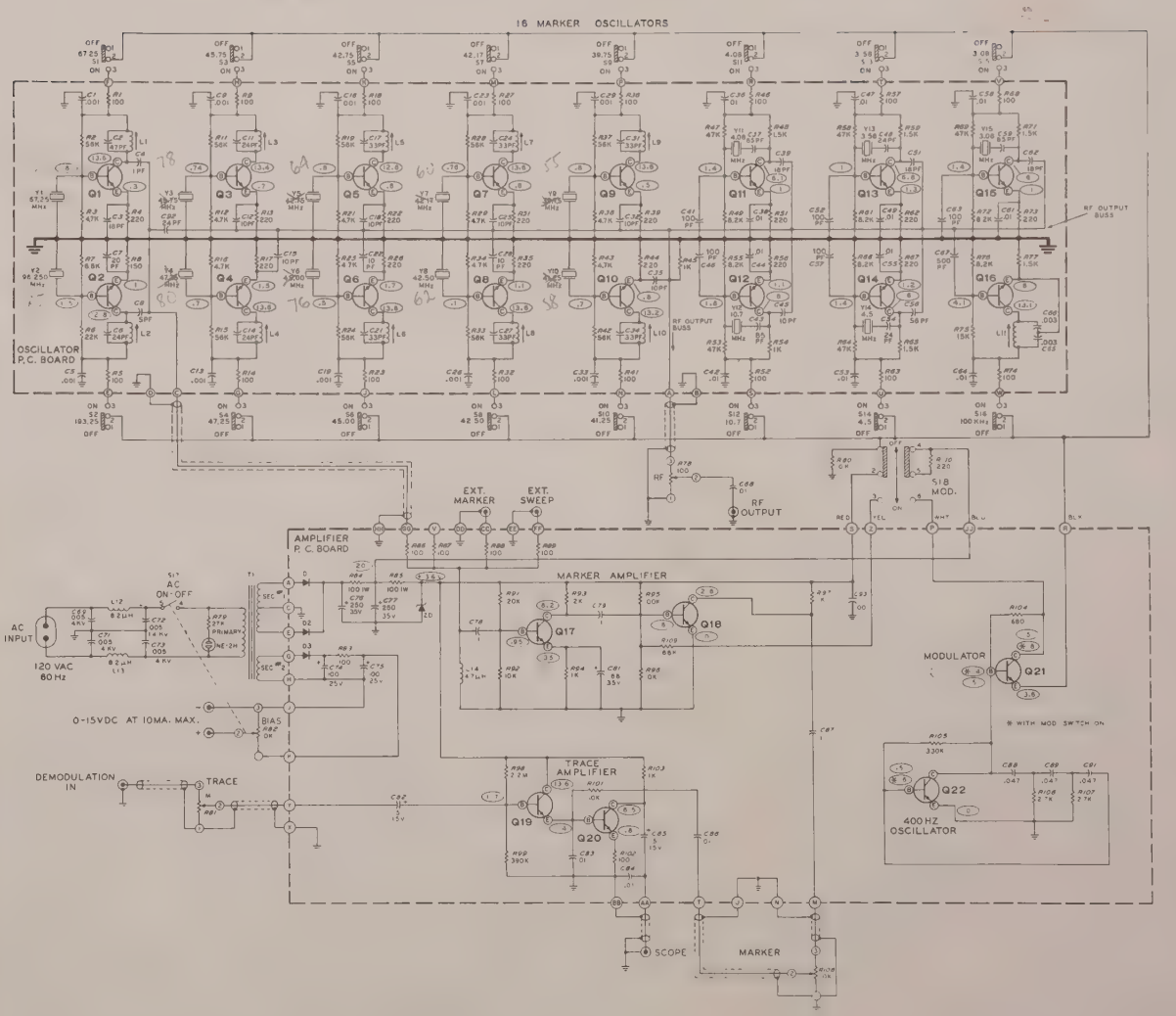
POWER SUPPLY

The power supply circuit operates from 120 V AC and produces two DC outputs: a regulated 13.6 V DC and an adjustable, low-current 0 to 10 V DC for external bias. The AC input is applied through a network consisting of an LC pi-type filter in each side of the AC line. This filter prevents any RF from being radiated back into the power line. A switch on the Bias control applies the AC line voltage to the primary winding of power transformer T1. An indicator lamp connected across the power transformer primary winding lights up when the power is turned on.

Transformer T1 is a step-down transformer with two secondary windings. Secondary winding number one is center-tapped and is connected as a conventional full-wave rectifier using diodes D1 and D2. The rectifier output is filtered by an RC pi-type filter and applied to zener diode ZD1 through a current limiting resistor. This results in a +13.6 volts DC ±10% output with respect to chassis ground. Secondary winding number two is connected to diode D3 in a conventional half-wave rectifier circuit. An RC pi-type filter applies the rectified and filtered output across the Bias control. This DC output is isolated from the common chassis return. Both the positive (+) and negative (-) sides connect to front panel binding parts. The voltage is adjustable from zero to 15 volts DC at a maximum of 10 mA and may be used as either a positive (+) or negative (-) source as required by the receiver being tested.

CHASSIS PHOTOGRAPHS

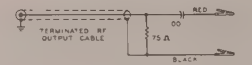




SCHEMATIC OF THE HEATHKIT® TV POST MARKER GENERATOR MODEL IG-14

NOTES

1. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS K = 1,000, M = 1,000,000
2. ALL CAPACITOR VALUES ARE IN uF UNLESS MARKED OTHERWISE.
3. (DC) INDICATES DC VOLTAGE MEASURED FROM POINT INDICATED TO GROUND. VOLTAGE READINGS TAKEN WITH AN 11 MEGOHM INPUT ELECTRONIC VOLTMETER. VOLTAGE MAY VARY ±20%
4. BIAS SUPPLY VOLTAGE IS ISOLATED FROM CHASSIS GROUND
5. ALL SWITCHES SHOWN IN THE OFF POSITION.
6. REFER TO THE CHASSIS PHOTOGRAPHS AND CIRCUIT BOARD X-RAY VIEWS FOR THE PHYSICAL LOCATION OF PARTS.
7. TRANSISTORS Q1 THROUGH Q16 ARE 2N3692 (6417-10). TRANSISTORS Q17 THROUGH Q22 ARE 2N3393 (6417-11).



REPLACEMENT PARTS PRICE LIST

PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1/2 Watt		
1-146	.10	75 Ω
1-3	.10	100 Ω
1-66	.10	150 Ω
1-45	.10	220 Ω
1-7	.10	680 Ω
1-9	.10	1000 Ω
1-11	.10	1500 Ω
1-13	.10	2700 Ω
1-16	.10	4700 Ω
1-19	.10	6800 Ω
1-73	.10	8200 Ω
1-20	.10	10 kΩ
1-109	.10	12 kΩ
1-21	.10	15 kΩ
1-22	.10	22 kΩ
1-23	.10	27 kΩ
1-25	.10	47 kΩ
1-47	.10	56 kΩ
1-60	.10	68 kΩ
1-26	.10	100 kΩ
1-121	.10	120 kΩ
1-31	.10	330 kΩ
1-32	.10	390 kΩ
1-37	.10	2.2 MΩ
1 Watt		
1-17-1	.10	100 Ω
CAPACITORS		
Disc		
21-78	.10	5 pF
21-3	.10	10 pF
21-60	.10	18 pF
21-5	.10	20 pF
21-84	.10	24 pF
21-7	.10	33 pF
21-32	.10	47 pF
21-85	.10	56 pF
21-96	.10	85 pF
21-9	.10	100 pF
21-13	.10	500 pF
21-14	.10	.001 μF
21-26	.10	.003 μF
21-72	.20	.005 μF, 1400 V (1.4 kV)
21-47	.15	.01 μF

PART No.	PRICE Each	DESCRIPTION
Electrolytic		
25-149	.45	5 μF, 15 V
25-194	.50	100 μF, 25 V
25-193	.60	250 μF, 35 V
Other Capacitors		
25-200	.50	.68 μF 85 V Tantalum
27-46	.15	.047 μF Mylar
27-47	.15	.1 μF Mylar
28-2	.10	1 pF phenolic
COILS-CHOKES-TRANSFORMER		
40-478	.25	Oscillator coil (brown)
40-479	.25	Oscillator coil (red)
40-820	.40	100 kHz oscillator coil
45-6	.20	8.2 μH choke
45-39	.20	4.7 μH choke
54-191	2.65	Power transformer
DIODES-TRANSISTORS		
57-27	.60	Silicon diode
56-32	1.50	13.6 volt zener diode
417-118	.55	2N3393 transistor
417-108	.55	2N3692 transistor
CRYSTALS		
404-332	4.20	3.080 MHz
404-333	4.20	4.080 MHz
404-4	3.10	4.5 MHz (4500 kHz)
404-39	4.30	10.7 MHz
404-238	3.00	3.579 MHz (3579.545 kHz)
404-334	3.30	39.750 MHz
404-335	3.30	41.250 MHz
404-336	3.30	42.170 MHz
404-337	3.30	42.500 MHz
404-344	3.30	42.750 MHz
404-338	3.30	45.000 MHz
404-339	3.30	45.750 MHz
404-340	3.30	47.250 MHz
404-341	3.90	67.250 MHz
404-342	3.90	96.625 MHz

PART No.	PRICE Each	DESCRIPTION
CONTROLS-SWITCHES		
19-116	1.00	10 kΩ control with push-pull switch (Bias)
10-225	.65	100 Ω control (RF)
10-223	.60	10 kΩ control (Marker)
10-224	.60	1 MΩ control (Trace)
60-32	.60	DPDT rocker switch
SOCKETS-CONNECTOR-PLUGS-STRIPS		
434-107	.25	Phono socket
432-4	.35	AC connector
432-58	1.95	Coaxial plug
438-4	.10	Phono plug
432-59	1.65	Coaxial connector
431-3	.10	3-lug terminal strip
431-11	.10	5-lug terminal strip
CABLE-WIRE		
89-3	.45	Line cord with plug
343-7	.05/ft	Small coaxial cable
343-9	.10/ft	Large coaxial cable
341-1	.05/ft	Black test lead
341-2	.05/ft	Red test lead
344-50	.05/ft	Black wire
344-52	.05/ft	Red wire
344-54	.05/ft	Yellow wire
344-56	.05/ft	Blue wire
344-59	.05/ft	White wire
HARDWARE		
#4 Hardware		
250-34	.05	4-40 x 1/2" screw
250-52	.05	4-40 x 1/4" screw
252-2	.05	4-40 nut, large
252-15	.05	4-40 nut, small
254-9	.05	#4 lockwasher
#6 Hardware		
250-56	.05	6-32 x 1/4" screw
250-162	.05	6-32 x 1/2" screw
250-229	.05	6-32 x 1/4" phillips screw
252-3	.05	6-32 nut
254-1	.05	#6 lockwasher
259-1	.05	#6 solder lug
250-303	.20	6-32 x 1/4" decorative head screw
250-304	.15	6-32 x 7/16" spacer stud

PART No.	PRICE Each	DESCRIPTION
Other Hardware		
252-7	.05	Control nut
254-4	.05	Control lockwasher
259-10	.05	Control solder lug
253-10	.05	Control flat washer
252-9	.05	Speednut
427-3	.15	Binding post base
455-50	.10	Knob bushing
METAL PARTS		
200-503	1.15	Chassis
203-503	1.40	Front panel
203-504	1.35	Rear panel
90-374	1.80	Cabinet half-shell
204-812	.65	Siderail
204-759-1	.20	End cap
204-811	.30	Switch bracket
210-35	2.90	Bezel
MISCELLANEOUS		
85-192-1	1.30	Amplifier circuit board
85-193-1	1.85	Oscillator circuit board
75-17	.10	Insulator bushing
100-16-2	.10	Black binding post cap
100-16-18	.10	Red binding post cap
413-10	.10	Red lens
412-15	.15	Neon lamp
462-248	.30	Knob
261-28	.10	Plastic foot
260-16	.10	Alligator clip
75-15	.30	Terminal shell (drilled)
75-16	.30	Terminal shell (plain)
211-34	.50	Handle
346-2	.05	Clear sleeving
490-1	.10	Plastic alignment tool
490-5	.10	Nut starter
331-6	.10	Solder
595-915	2.00	Manual

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Selling prices elsewhere in U.S.A. may be slightly higher to offset transportation and local taxes. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties and rates of exchange.

U.S. TELEVISION CHANNEL FREQUENCIES

41.25 Sound I.F. 45.75 Pix I.F.

CHANNEL	BAND	CENTER FREQ.	PIX CARRIER	SOUND CARRIER	OSC. FREQ.	PIX IMAGE FREQ.	CHANNEL	BAND	CENTER FREQ.	PIX CARRIER	SOUND CARRIER	OSC. FREQ.	PIX IMAGE FREQ.
2	54 - 60	57	55.25	59.75	101	146.75	43	644 - 650	647	645.25	649.75	691	736.75
3	60 - 60	63	61.25	65.75	107	152.75	44	650 - 656	653	651.25	655.75	697	742.75
4	66 - 72	69	67.25	71.75	113	158.75	45	656 - 662	659	657.25	661.75	703	748.75
5	76 - 82	79	77.25	81.75	123	168.75	46	662 - 668	665	663.25	667.75	709	754.75
6	82 - 88	85	83.25	87.75	129	174.75	47	668 - 674	671	669.25	673.75	715	760.75
7	174 - 180	177	175.25	179.75	221	266.75	48	674 - 680	677	675.25	679.75	721	766.75
8	180 - 186	183	181.25	185.75	227	272.75	49	680 - 686	683	681.25	685.75	727	772.75
9	186 - 192	189	187.25	191.75	233	278.75	50	686 - 692	689	687.25	691.75	733	778.75
10	192 - 198	195	193.25	197.75	239	284.75	51	692 - 698	695	693.25	697.75	739	784.75
11	198 - 204	201	199.25	203.75	245	290.75	52	698 - 704	701	699.25	703.75	745	790.75
12	204 - 210	207	205.25	209.75	251	296.75	53	704 - 710	707	705.25	709.75	751	796.75
13	210 - 216	213	211.25	215.75	257	302.75	54	710 - 716	713	711.25	715.75	757	802.75
14	470 - 476	473	471.25	475.75	517	562.75	55	716 - 722	719	717.25	721.75	763	808.75
15	476 - 482	479	477.25	481.75	523	568.75	56	722 - 728	725	723.25	727.75	769	814.75
16	482 - 488	485	483.25	487.75	529	574.75	57	728 - 734	731	729.25	733.75	775	820.75
17	488 - 494	491	489.25	493.75	535	580.75	58	734 - 740	737	735.25	739.75	781	826.75
18	494 - 500	497	495.25	499.75	541	586.75	59	740 - 746	743	741.25	745.75	787	832.75
19	500 - 506	503	501.25	505.75	547	592.75	60	746 - 752	749	747.25	751.75	793	838.75
20	506 - 512	509	507.25	511.75	553	598.75	61	752 - 758	755	753.25	757.75	799	844.75
21	512 - 518	515	513.25	517.75	559	604.75	62	758 - 764	761	759.25	763.75	805	850.75
22	518 - 524	521	519.25	523.75	565	610.75	63	764 - 770	767	765.25	769.75	811	856.75
23	524 - 530	527	525.25	529.75	571	616.75	64	770 - 776	773	771.25	775.75	817	862.75
24	530 - 536	533	531.25	535.75	577	622.75	65	776 - 782	779	777.25	781.75	823	868.75
25	536 - 542	539	537.25	541.75	583	628.75	66	782 - 788	785	783.25	787.75	829	874.75
26	542 - 548	545	543.25	547.75	589	634.75	67	788 - 794	791	789.25	793.75	835	880.75
27	548 - 554	551	549.25	553.75	595	640.75	68	794 - 800	797	795.25	799.75	841	886.75
28	554 - 560	557	555.25	559.75	601	646.75	69	800 - 806	803	801.25	805.75	847	892.75
29	560 - 566	563	561.25	565.75	607	652.75	70	806 - 812	809	807.25	811.75	853	898.75
30	566 - 572	569	567.25	571.75	613	658.75	71	812 - 818	815	813.25	817.75	859	904.75
31	572 - 578	575	573.25	577.75	619	664.75	72	818 - 824	821	819.25	823.75	865	910.75
32	578 - 584	581	579.25	583.75	625	670.75	73	824 - 830	827	825.25	829.75	871	916.75
33	584 - 590	587	585.25	589.75	631	676.75	74	830 - 836	833	831.25	835.75	877	922.75
34	590 - 596	593	591.25	595.75	637	682.75	75	836 - 842	839	837.25	841.75	883	928.75
35	596 - 602	599	597.25	601.75	643	688.75	76	842 - 848	845	843.25	847.75	889	934.75
36	602 - 608	605	603.25	607.75	649	694.75	77	848 - 854	851	849.25	853.75	895	940.75
37	608 - 614	611	609.25	613.75	655	700.75	78	854 - 860	857	855.25	859.75	901	946.75
38	614 - 620	617	615.25	619.75	661	706.75	79	860 - 866	863	861.25	865.75	907	952.75
39	620 - 626	623	621.25	625.75	667	712.75	80	866 - 872	869	867.25	871.75	913	958.75
40	626 - 632	629	627.25	631.75	673	718.75	81	872 - 878	875	873.25	877.75	919	964.75
41	632 - 638	635	633.25	637.75	679	724.75	82	878 - 884	881	879.25	883.75	925	970.75
42	638 - 644	641	639.25	643.75	685	730.75	83	884 - 890	887	885.25	889.75	931	976.75

HEATH COMPANY

BENTON HARBOR, MICHIGAN

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